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Transmitting Power by Leather Belting*

A Series of Tables, Embodying Latest Investigations, Showing Tensions and Horsepowers at Which Belts Will Give Best Service and Cost the Least for Maintenance and Repairs

BY ROBERT THURSTON KENT

THE laying out of a belt drive, assuming the pulley sizes to have been determined, involves the answer to each of three separate questions if the drive is to be designed to give the most satisfactory results. These are: What horsepower is to be transmitted? What size of belt should be used to transmit it? Under what tension should the belt be placed on the pulleys? To within a comparatively recent time the first of these questions was the only one that any attempt was made to answer in laying out a belt drive. Some rule-of-thumb, such as "A single belt 1 in. wide, traveling 1100 ft. per minute, will transmit 1 hp.," was then applied to find out how wide a belt was necessary. Such a procedure gave results that were anything but satisfactory. While the belt could and probably did do the work required of it, it was at the expense of power, bearings and the belt itself.

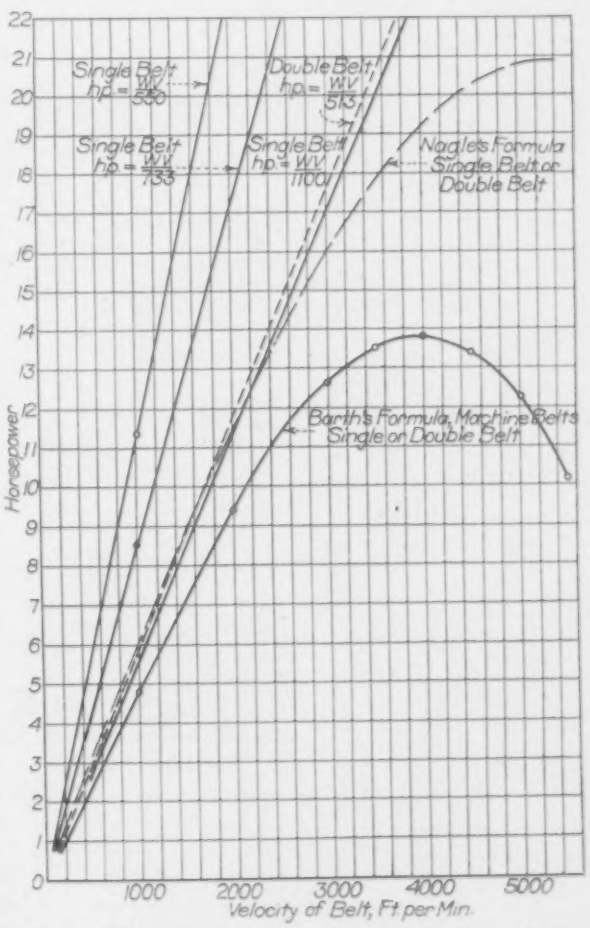

Fig. 1—Comparison of Various Formulas for Horsepower Transmitted by Belting

THE MOST SATISFACTORY BELT DRIVE

The most satisfactory belt drive is that one which will at all times transmit the necessary amount of power, and at the same time cost the least for repairs and maintenance, and cause the least possible loss by machine shutdowns for the purpose of making belt repairs in working hours. It is a fact that almost any belt can be made to transmit any amount of power up to the limit of the strength of the belt by increasing the tension under which it is placed on the pulleys. Any increase in the initial tension beyond a certain figure, which varies with the conditions, will result in a decreased life of the belt, more frequent breakdowns, greater pressure on the bearings, with a consequently increased expenditure of power, all contributing to a higher cost for belt maintenance. Therefore, while the first cost of a properly designed drive may be somewhat higher than that of one laid out according to some rule-of-thumb, the extra expenditure will be justified by the greater service that will be obtained from the more expensive belt and the actually lower total cost, taken over a term of years, which includes not only the first cost, but also the charges for repairs and maintenance and the loss caused by belt breakdowns in working hours.

FACTORS TO BE CONSIDERED IN BELT DRIVES

The earlier rules for belting practice considered but two factors: speed of belt and horsepower to be transmitted. As a matter of fact the theory of transmitting power by belting shows that there are other factors to be considered, and the work of such investigators as Taylor, Barth and Nagle has indicated that there are still other practical considerations that cannot be neglected if the drive is to be satisfactory. To have a belt drive that is to transmit a predetermined horsepower and show the lowest total cost, the following considerations must be taken into account when the drive is laid out: The conditions of use of the belt, whether it drives a machine and is readily accessible, or whether it drives a countershaft or some other inaccessible pulley; the velocity at which the belt will travel; the arc of the pulley with which the belt is in con-

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tact; the tension per square inch of cross-section under which it is first placed on the pulleys; the tension per square inch of cross-section to which the belt may be allowed to fall in service before it is taken down and retightened. A variation in any one of these factors will affect the horse-power that the belt will transmit, and will also affect the life of the belt and the total cost of it.

TABLE I.—HORSEPOWER AND MAXIMUM AND MINIMUM TENSIONS OF LEATHER BELTS PER SQUARE INCH OF CROSS SECTIONAL AREA

Velocity of Belt, Ft. per Min.	MACHINE BELTS				COUNTERSHAFT BELTS			
	Horse-power	Initial Tension, t_m, Lb.	Minimum Tension, t_0, Lb.	Effective Pull, p, Lb.	Horse-power	Initial Tension, t_m, L.	Minimum Tension, t_0, Lb.	Effective Pull, p, Lb.
180 Degrees Arc of Contact								
250	1.05	183.75	127.5	138.1	0.70	141.0	85.0	92.0
500	2.27	180.25	124.0	149.5	1.51	139.0	82.5	99.4
750	3.53	179.0	121.75	155.3	2.34	138.0	81.25	103.2
1000	4.78	178.5	120.0	156.7	3.15	137.75	81.0	103.9
1200	5.77	178.0	120.5	158.6	3.78	137.75	81.0	104.0
1400	6.72	178.0	120.5	158.4	4.38	138.0	81.25	103.3
1600	7.64	178.25	121.0	156.6	4.96	138.25	81.75	102.0
1800	8.53	178.5	121.5	156.3	5.47	138.75	82.25	100.3
2000	9.36	179.25	122.0	154.5	5.95	139.0	83.0	98.1
2500	11.20	181.0	124.5	147.8	6.88	141.25	85.5	90.9
3000	12.62	183.5	127.5	138.8	7.40	143.5	88.5	81.4
3500	13.51	186.75	131.0	127.4	7.39	146.25	91.75	69.7
4000	13.80	190.0	135.0	103.8	6.77	149.5	95.25	55.9
4500	13.40	193.75	139.25	98.2	5.46	152.5	98.75	40.1
5000	12.20	197.75	143.75	80.5	3.37	156.0	103.0	22.2
5500	10.15	201.75	148.25	60.9	0.40	159.5	106.25	2.4
170 Degrees Arc of Contact								
250	1.0	185.25	129.5	132.6	0.67	142.0	86.25	88.3
500	2.18	182.0	125.75	143.9	1.45	140.0	84.0	95.7
750	3.40	180.75	123.5	149.7	2.26	139.0	82.5	99.3
1000	4.61	180.0	123.0	152.0	3.04	139.0	82.25	100.3
1200	5.57	179.5	122.5	153.3	3.65	138.75	82.25	100.6
1400	6.49	179.5	122.5	153.0	4.23	139.0	82.50	99.7
1600	7.38	180.0	123.0	152.3	4.78	139.0	83.00	98.5
1800	8.24	180.25	123.25	151.1	5.29	139.50	83.5	97.0
2000	9.05	180.75	123.75	149.4	5.75	140.0	84.25	94.0
2500	10.83	182.5	126.0	143.0	6.66	142.0	86.5	87.9
3000	12.21	184.75	129.0	134.3	7.16	144.25	89.25	78.7
3500	13.08	187.75	132.25	123.3	7.15	146.75	92.25	67.4
4000	13.37	191.0	136.0	110.3	6.56	149.75	95.75	54.1
4500	12.97	194.5	140.25	95.1	5.29	152.75	99.0	38.8
5000	11.81	198.5	144.5	78.0	3.26	156.25	103.25	21.5
5500	9.83	202.25	148.75	59.0	0.39	159.5	106.25	2.3
160 Degrees Arc of Contact								
250	0.96	186.25	131.0	126.9	0.64	143.0	87.5	84.5
500	2.09	183.75	127.75	138.3	1.39	141.0	85.25	91.8
750	3.27	182.25	125.75	143.8	2.17	140.0	84.0	95.8
1000	4.43	181.75	125.0	146.2	2.92	140.0	83.5	96.4
1200	5.36	181.25	124.5	147.3	3.51	139.75	83.5	96.7
1400	6.25	181.25	124.5	147.2	4.07	140.0	83.75	96.0
1600	7.11	181.25	125.0	146.6	4.60	140.25	84.25	94.9
1800	7.94	181.75	125.25	145.5	5.09	140.5	84.75	93.4
2000	8.72	182.25	126.75	143.8	5.54	141.0	85.25	91.4
2500	10.44	184.0	127.75	137.8	6.42	142.75	87.5	84.7
3000	11.77	186.0	130.5	129.5	6.90	144.75	90.0	75.9
3500	12.61	189.0	133.5	119.0	6.90	147.25	93.75	65.0
4000	12.89	192.0	137.0	106.4	6.33	150.25	96.25	52.2
4500	12.52	195.25	141.0	91.8	5.11	153.25	99.5	37.5
5000	11.40	199.0	145.0	75.2	3.15	156.5	103.5	20.8
5500	9.49	202.75	149.25	56.9	0.38	159.5	106.25	2.3
150 Degrees Arc of Contact								
250	0.92	188.25	132.75	120.9	0.61	143.75	88.7	80.5
500	2.00	185.5	129.5	131.8	1.33	142.0	86.5	87.7
750	3.12	184.0	128.0	137.4	2.07	141.0	85.5	91.1
1000	4.24	183.25	127.0	140.0	2.80	141.0	85.0	92.3
1200	5.13	183.0	126.5	141.2	3.37	140.75	85.0	92.6
1400	5.99	183.0	126.5	141.2	3.90	141.0	85.0	92.0
1600	6.82	183.0	127.0	140.6	4.41	141.25	85.5	91.0
1800	7.62	183.5	127.0	139.6	4.89	141.5	86.0	89.6
2000	8.37	183.75	127.5	138.0	5.32	142.0	86.5	87.7
2500	10.02	185.5	129.5	132.3	6.16	143.5	88.5	81.3
3000	11.31	187.5	132.0	124.4	6.63	145.5	90.75	72.9
3500	12.12	190.0	135.0	114.3	6.63	148.0	93.5	62.5
4000	12.39	193.0	138.25	102.2	6.08	150.5	96.75	50.2
4500	12.03	196.0	142.0	88.2	4.91	153.5	99.75	36.0
5000	10.96	199.75	145.75	72.3	3.02	156.5	103.75	20.0
5500	9.12	203.25	149.75	54.7	0.36	159.75	106.25	2.2
140 Degrees Arc of Contact								
250	0.87	190.0	134.75	114.6	0.58	144.75	90.0	76.3
500	1.90	187.0	131.5	125.3	1.26	143.25	87.75	83.3
750	2.98	185.75	130.0	131.0	1.97	142.25	86.75	86.8
1000	4.04	185.0	129.0	133.4	2.67	142.0	86.5	88.0
1200	4.90	184.75	128.5	134.6	3.21	141.75	86.5	88.3
1400	5.71	184.75	128.5	134.7	3.73	142.0	86.5	87.8
1600	6.51	185.0	129.0	134.2	4.21	142.25	86.75	86.9
1800	7.27	185.0	129.25	133.3	4.67	142.5	87.25	85.5
2000	7.99	185.5	129.5	131.9	5.08	143.0	87.75	83.8
2500	9.57	187.0	131.5	126.4	5.89	144.5	89.5	77.7
3000	10.81	189.0	133.5	118.8	6.34	146.25	91.75	69.7
3500	11.59	191.25	136.5	109.2	6.34	148.5	94.25	59.8
4000	11.85	194.0	139.25	97.7	5.82	151.0	97.5	48.0
4500	11.50	197.0	143.0	84.4	4.69	153.75	100.25	34.4
5000	10.48	200.25	146.5	69.2	2.89	156.75	104.0	19.1
5500	8.73	203.75	150.25	52.4	0.35	159.75	106.25	2.1
130 Degrees Arc of Contact								
250	0.82	191.5	136.75	108.1	0.55	145.75	91.25	72.0
500	1.72	189.0	133.5	118.5	1.20	144.25	89.25	78.8
750	2.82	187.5	132.0	124.4	1.87	143.25	88.25	82.3
1000	3.83	187.0	131.25	126.5	2.53	143.0	87.75	83.4
1200	4.64	186.5	130.70	127.7	3.05	143.0	87.75	83.8
1400	5.42	186.5	130.75	127.8	3.54	143.0	87.75	83.3
1600	6.18	186.75	131.0	127.4	4.00	143.5	88.25	82.5
1800	6.91	187.0	131.25	126.6	4.43	143.5	88.50	81.3
2000	7.59	187.25	131.75	125.3	4.82	144.0	89.0	79.6
2500	9.10	188.5	133.25	120.2	5.60	145.5	90.5	73.8
3000	10.27	190.5	135.25	113.0	6.02	147.0	92.75	66.3
3500	11.02	192.5	137.75	103.9	6.03	149.25	95.0	56.8
4000	11.26	195.0	140.5	93.0	5.53	151.5	98.25	45.6
4500	10.94	198.0	144.0	80.3	4.46	154.25	100.5	32.7
5000	9.97	201.0	147.25	65.8	2.75	156.75	104.0	18.2
5500	8.30	204.25	150.75	49.8	0.33	159.75	106.25	2.0
120 Degrees Arc of Contact								
250	0.77	193.0	138.5	101.3	0.51	146.75	92.5	67.5
500	1.68	190.75	137.5	111.3	1.12	145.5	90.5	73.7
750	2.65	189.5	134.25	116.7	1.76	144.5	89.5	77.4
1000	3.61	189.5	133.0	119.1	2.38	144.25	89.25	78.6
1200	4.37	188.5	132.75	120.2	2.87	144.0	89.25	78.9
1400	5.11	188.5	132.75	120.5	3.34	144.0	89.25	78.7
1600	5.83	188.5	133.25	120.2	3.77	144.5	89.5	77.8
1800	6.53	188.5	133.25	119.8	4.18	144.75	89.75	76.7
2000	7.17	189.0	133.5	118.2	4.55	145.0	90.25	75.1
2500	8.60	190.25	135.0	113.5	5.29	146.25	91.75	69.7
3000	9.71	191.75	137.0	106.8	5.69	148.0	93.5	62.6
3500	10.41	193.75	139.25	98.2	5.70	149.75	95.75	53.7
4000	10.65	196.25	142.0	87.9	5.23	152.0	99.0	43.1
4500	10.35	199.0	145.0	76.0	4.22	154.5	101.0	31.0
5000	9.43	201.75	148.0	62.2	2.60	157.0	104.25	17.2
5500	7.85	204.75	151.25	47.1	0.32	159.75	106.25	1.9

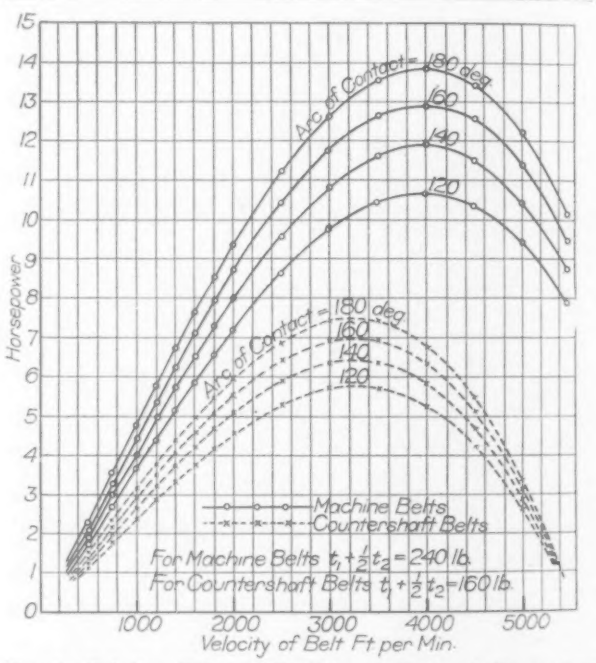


Fig. 2—Relation Between Velocity of Belt and Horsepower Transmitted, per Square Inch of Belt Cross-Section. Horsepower Computed by Means of Barth's Formulas

The tables which accompany this article are based on the latest investigations of belting practice—those of Carl G. Barth—and show the horsepower that will be transmitted under any given set of conditions, and also the initial tensions under which the belts should be put up, and the minimum tensions to which they may be allowed to fall in service before retightening. The formulas upon which they are based will be explained after examples in the use of the tables have been given.

The arc of contact of the belt on the pulley has a direct bearing on the horsepower that can be transmitted and should be determined first. The arc on the smaller pulley is the one that should be considered, as the horsepower transmitted is limited by it. If the smaller pulley is the driver, it limits the amount of power that can be delivered to the belt, while if it is the driven it limits the amount

TABLE II.—CROSS SECTIONAL AREA OF BELTS, SQUARE INCHES

Width of Belt, In.	THICKNESS OF BELT, INCHES															
	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
1	0.125	0.188	0.25	0.313	0.375	0.438	0.50	0.563	0.625	0.688	0.75	0.813	0.875	0.938	1.00
1½	0.188	0.281	0.375	0.469	0.563	0.656	0.75	0.844	0.938	1.031	1.125	1.219	1.313	1.406	1.50
2	0.25	0.375	0.50	0.625	0.75	0.875	1.00	1.125	1.25	1.375	1.50	1.625	1.75	1.875	2.00
2½	0.313	0.469	0.625	0.779	0.938	1.094	1.25	1.407	1.563	1.719	1.875	2.031	2.188	2.344	2.50
3	0.375	0.563	0.75	0.938	1.125	1.313	1.50	1.688	1.875	2.063	2.25	2.438	2.625	2.813	3.00
3½	0.438	0.656	0.875	1.094	1.313	1.521	1.75	1.969	1.188	2.406	2.625	2.844	3.063	3.281	3.50
4	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
4½	0.563	0.844	1.125	1.404	1.688	1.969	2.25	2.532	2.813	3.094	3.375	3.656	3.938	4.219	4.50
5	0.625	0.938	1.25	1.563	1.875	2.188	2.50	2.813	3.125	3.438	3.75	4.063	4.375	4.688	5.00
5½	0.688	1.032	1.375	1.717	2.063	2.407	2.75	3.095	3.438	3.782	4.125	4.469	4.813	5.157	5.50
6	0.75	1.125	1.50	1.875	2.25	2.625	3.00	3.375	3.75	4.125	4.50	4.875	5.25	5.625	6.00
7	0.875	1.313	1.75	2.188	2.625	3.063	3.50	3.938	4.375	4.813	5.25	5.688	6.125	6.563	7.00
8	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00
9	1.125	1.688	2.25	2.813	3.375	3.938	4.50	5.063	5.625	6.188	6.75	7.313	7.875	8.438	9.00
10	1.25	1.875	2.50	3.125	3.75	4.375	5.00	5.625	6.25	6.875	7.50	8.125	8.75	9.375	10.00
11	1.375	2.063	2.75	3.438	4.125	4.813	5.50	6.188	6.875	7.563	8.25	8.938	9.625	10.313	11.00
12	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50	8.25	9.00	9.75	10.50	11.25	12.00
14	1.75	2.625	3.50	4.375	5.25	6.125	7.00	7.875	8.75	9.625	10.50	11.375	12.25	13.125	14.00
16	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
18	2.25	3.375	4.50	5.625	6.75	7.875	9.00	10.125	11.25	12.375	13.50	14.625	15.75	16.875	18.00
20	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50	13.75	15.00	16.25	17.50	18.75	20.00
22	2.75	4.125	5.50	6.875	8.25	9.625	11.00	12.375	13.75	15.125	16.50	17.875	19.25	20.625	22.00
24	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00	16.50	18.00	19.50	21.00	22.50	24.00
26	3.25	4.875	6.50	8.125	9.75	11.375	13.00	14.625	16.25	17.875	19.50	21.125	22.75	24.375	26.00
28	3.50	5.250	7.00	8.75	10.50	12.25	14.00	15.75	17.50	19.25	21.00	22.75	24.50	26.25	28.00
30	3.75	5.625	7.50	9.375	11.25	13.125	15.00	16.875	18.75	20.625	22.50	24.375	26.25	28.125	30.00
36	4.50	6.75	9.00	11.25	13.50	15.75	18.00	20.25	22.50	24.75	27.00	29.25	31.50	33.75	36.00
42	5.25	7.875	10.50	13.125	15.75	18.375	21.00	23.625	26.25	28.875	31.50	34.125	36.75	39.375	42.00
48	6.00	9.00	12.00	15.00	18.00	21.00	24.00	27.00	30.00	33.00	36.00	39.00	42.00	45.00	48.00
54	6.75	10.125	13.50	16.875	20.25	23.625	27.00	30.375	33.75	37.125	40.50	43.875	47.25	50.625	54.00
60	7.50	11.25	15.00	18.75	22.50	26.25	30.00	33.75	37.50	41.25	45.00	48.75	52.50	56.25	60.00
66	8.25	12.375	16.50	20.625	24.75	28.875	33.00	37.125	41.25	45.375	49.50	53.625	57.75	61.875	66.00
72	9.00	13.50	18.00	22.50	27.00	31.50	36.00	40.50	45.00	49.50	54.00	58.50	63.00	67.50	72.00

TABLE III.—ARC OF CONTACT OF BELT ON SMALLER PULLEY, DEGREES

Center to Center Distance of Pulleys, Ft.	DIFFERENCE IN DIAMETER OF PULLEYS, INCHES																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
2	178	175	173	170	168	166	163	161	158	156	153	151	149	146	144	141	139	136	..	..	..
2½	178	176	174	172	170	169	167	165	163	161	159	157	155	153	151	149	147	145	143	141	139
3	178	177	175	174	172	170	169	167	166	164	162	161	159	158	156	155	153	151	149	148	146
3½	179	177	176	175	173	172	170	169	168	166	165	164	162	161	159	158	157	155	154	152	151
4	179	178	176	175	174	173	172	170	169	168	167	166	164	163	162	161	160	158	157	156	155
4½	179	178	177	176	175	174	173	172	170	169	168	167	166	165	164	163	162	161	160	159	158
5	179	178	177	176	175	174	173	172	171	170	169	169	168	167	166	165	164	163	162	161	160
5½	179	178	177	177	176	175	174	173	172	171	170	170	169	168	167	166	165	164	163	163	162
6	179	178	177	177	176	175	174	174	173	172	171	170	170	169	168	167	166	166	165	164	163
6½	179	179	178	177	176	176	175	174	173	173	172	171	170	170	169	168	167	167	166	165	165
7	179	179	178	177	177	176	175	175	174	173	172	172	171	170	170	169	168	168	167	166	166
7½	179	179	178	177	177	176	176	175	174	174	173	172	172	171	170	170	169	169	168	167	167
8	179	179	178	178	177	177	176	175	175	174	174	173	173	172	171	171	170	170	169	169	168
8½	179	179	178	178	177	177	176	176	175	174	174	173	173	172	172	171	170	170	169	169	168
9	179	179	178	178	177	177	176	176	175	175	174	174	173	173	172	172	171	170	170	169	169
9½	179	179	178	178	177	177	176	176	175	175	174	174	173	173	172	172	171	171	170	170	169
10	180	179	179	178	178	177	177	176	176	175	175	174	174	173	173	172	172	171	171	170	170
11	180	179	179	178	178	177	177	177	176	176	175	175	174	174	173	173	173	172	172	171	171
12	180	179	179	178	178	178	177	177	176	176	176	175	175	174	174	174	173	173	172	172	172
13	180	179	179	179	178	178	177	177	177	176	176	176	175	175	174	174	174	173	173	173	172
14	180	179	179	179	178	178	178	177	177	177	176	176	176	176	175	175	175	174	174	174	173
15	180	179	179	179	178	178	178	177	177	177	176	176	176	176	176	175	175	175	174	174	174
16	180	179	179	179	179	178	178	178	177	177	177	176	176	176	176	176	175	175	175	174	174
17	180	179	179	179	179	178	178	178	177	177	177	177	176	176	176	176	176	175	175	175	174
18	180	179	179	179	179	178	178	178	178	177	177	177	177	176	176	176	176	175	175	175	174
19	180	179	179	179	179	178	178	178	178	177	177	177	177	176	176	176	176	176	175	175	175
20	180	180	179	179	179	179	178	178	178	178	177	177	177	177	176	176	176	176	175	175	175

Center to Center Distance of Pulleys, Ft.	DIFFERENCE IN DIAMETER OF PULLEYS, INCHES																				
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2½	137	135	133	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	145	143	141	139	138	136	134	132	131	..	..	..	..	..	..	..	..	..	..	..	..
3½	150	148	147	145	144	143	141	140	138	137	135	134	132	131	129	..	..	..	..	..	..
4	154	152	151	150	149	147	146	145	144	142	141	140	139	137	136	135	133	132	131	129	128
4½	156	155	154	153	152	151	150	149	148	147	146	144	143	142	141	140	139	138	137	135	134
5	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139
5½	161	160	159	158	157	156	156	155	154	153	152	151	150	149	148	147	147	146	145	144	143
6	162	162	161	160	159	158	158	157	156	155	154	154	153	152	151	150	149	149	148	147	146
6½	164	163	162	162	161	160	159	158	158	157	156	156	155	154	153	153	152	151	150	150	149
7	165	164	164	163	162	162	161	160	159	159	158	157	156	156	155	155	154	153	152	152	151
7½	166	165	165	164	163	163	162	161	161	160	160	159	158	158	157	156	156	155	154	154	153
8	167	167	166	166	165	164	164	163	163	161	161	160	160	159	159	158	157	157	156	156	155
8½	168	167	166	166	165	165	164	164	163	163	162	161	161	160	160	159	159	158	157	157	156
9	168	168	167	167	166	166	165	165	164	164	163	162	162	161	161	160	160	159	159	158	158
9½	169	168	168	167	167	166	166	165	165	164	164	163	163	162	162	161	161	160	160	159	159
10	170	169	169	168	168	167	167	166	166	165	165	164	164	163	163	162	162	161	161	160	160
11	170	170	170	169	169	168	168	167	167	167	166	166	165	165	164	164	163	163	163	162	162
12	171	171	170	170	170	169	169	168	168	168	167	167	166	166	166	165	165	164	164	164	163
13	172	172	171	171	170	170	170	169	169	169	168	168	168	167	167	166	166	166	165	165	165
14	173	172	172	171	171	171	170	170	170	169	169	169	168	168	168	167	167	167	166	166	166
15	173	173	172	172	172	171	171	171	170	170	170	170	169	169	169	168	168	168	167	167	167
16	173	173	173	173	172	172	172	171	171	171	170	170	170	170	169	169	169	168	168	168	167
17	174	174	173	173	173	172	172	172	172	171	171	171	170	170	170	170	169	169	169	168	168
18	174	174	174	173	173	173	173	172	172	172	172	171	171	171	170	170	170	170	169	169	169
19	174	174	174	174	173	173	173	173	172	172	172	172	172	171	171	171	171	170	170	170	169
20	175	175	174	174	174	174	173	173	173	173	172	172	172	172	171	171	171	171	170	170	170

TABLE IV.—VELOCITY OF BELTS, FEET PER MINUTE

R.P.M.	DIAMETER OF PULLEY, INCHES															
	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	11
90	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	259.2
100	....	....	....	....	....	....	....	....	....	....	....	....	....	....	261.8	288.0
110	....	....	....	....	....	....	....	....	....	....	....	....	259.2	273.6	288.0	316.8
120	....	....	....	....	....	....	....	....	....	....	251.3	267.0	282.7	298.4	314.2	345.6
130	....	....	....	....	....	....	....	....	....	255.2	272.2	289.3	306.3	323.3	340.3	374.4
140	....	....	....	....	....	....	....	....	256.4	274.8	293.2	311.6	329.8	348.2	366.5	403.2
150	....	....	....	....	....	....	....	255.2	274.8	294.5	314.1	333.8	353.4	373.1	392.7	432.0
160	....	....	....	....	....	....	251.4	272.2	293.1	314.1	335.0	356.0	377.0	397.9	418.9	460.8
170	....	....	....	....	....	....	267.1	289.2	311.4	333.7	356.0	378.3	400.5	422.8	445.1	489.6
180	....	....	....	....	....	259.2	282.8	306.2	329.8	353.3	376.9	400.5	424.1	447.7	471.2	518.4
190	....	....	....	....	....	273.6	298.5	323.2	348.1	373.0	397.9	422.8	447.6	472.5	497.4	547.2
200	....	....	....	....	261.8	288.0	314.2	340.2	366.4	392.6	418.8	445.0	471.2	497.4	523.6	576.0
220	....	....	....	259.2	288.0	316.8	345.6	374.2	403.0	431.9	460.7	489.5	518.3	547.1	576.0	633.6
240	....	....	250.9	282.7	314.2	345.6	377.0	408.2	439.7	471.1	503.6	534.0	565.4	596.9	628.3	691.2
260	....	....	271.8	306.3	340.3	374.4	408.5	442.3	476.3	510.4	544.4	578.5	612.6	646.6	680.7	748.8
280	....	256.6	292.7	329.8	366.5	403.2	439.9	476.3	513.0	549.6	586.3	623.0	659.7	696.4	733.0	806.4
300	....	275.0	313.7	353.4	392.7	432.0	471.3	510.3	549.6	588.9	628.2	667.5	706.8	746.1	785.4	864.0
320	251.3	293.3	334.6	376.9	418.9	460.8	502.7	544.5	586.2	628.2	670.1	712.0	753.9	795.8	837.7	921.6
340	267.0	311.6	355.5	400.5	445.1	489.6	534.1	578.3	622.9	667.4	712.0	756.5	801.0	845.6	890.1	979.2
360	282.7	330.0	376.4	424.1	471.2	518.4	565.6	612.4	659.2	706.7	753.8	801.0	848.2	895.3	942.5	1036.8
380	298.5	348.3	397.3	447.6	497.4	547.2	597.0	646.4	696.2	745.9	795.7	845.4	895.3	945.1	994.8	1094.4
400	314.2	366.6	418.2	471.2	523.6	576.0	628.4	680.4	732.8	785.2	837.6	890.0	942.4	994.8	1047.2	1152.0
450	353.4	412.5	470.5	530.0	589.0	648.0	707.0	765.4	824.4	883.4	942.3	1001.2	1060.2	1119.1	1178.1	1296.0
500	392.7	458.3	522.8	589.0	654.5	720.0	785.5	850.5	916.0	981.5	1047.0	1112.5	1178.0	1243.5	1309.0	1440.0
550	432.0	504.1	575.1	647.9	719.9	792.0	864.0	935.5	1007.6	1079.6	1151.7	1213.8	1295.8	1367.9	1439.9	1584.0
600	471.2	550.0	627.3	706.8	785.4	864.0	942.6	1020.6	1099.2	1177.8	1256.4	1335.0	1413.6	1492.2	1570.8	1728.0
650	510.5	595.8	679.5	765.7	850.8	936.0	1021.2	1105.6	1190.1	1276.0	1370.1	1446.2	1531.4	1616.6	1701.7	1872.0
700	549.8	641.6	731.8	824.6	916.3	1008.0	1099.7	1190.7	1282.4	1374.1	1465.8	1557.5	1649.2	1740.9	1832.6	2016.0
800	628.3	733.3	836.4	942.4	1047.2	1152.0	1256.8	1360.8	1465.5	1570.4	1675.2	1780.0	1884.8	1989.6	2094.4	2304.0
900	706.9	824.9	940.9	1060.2	1178.1	1296.0	1413.9	1530.9	1648.8	1766.7	1884.6	2002.5	2120.4	2238.3	2356.2	2592.0
1000	785.4	916.6	1045.5	1178.0	1309.0	1440.0	1571.0	1701.0	1832.0	1963.0	2094.0	2225.0	2356.0	2487.0	2618.0	2880.0
1100	863.9	1008.3	1050.0	1295.8	1439.9	1584.0	1728.1	1871.1	2015.2	2159.3	2303.4	2447.5	2591.6	2735.7	2879.8	3168.0
1200	942.5	1100.0	1254.6	1413.6	1570.8	1728.0	1885.2	2041.2	2198.4	2355.6	2512.8	2670.0	2827.2	2984.4	3141.6	3456.0
1300	1021.0	1191.6	1359.1	1531.4	1701.7	1872.0	2042.3	2211.3	2381.6	2551.9	2722.2	2892.5	3062.8	3233.1	3403.4	3744.0
1400	1099.6	1283.2	1463.7	1649.2	1832.6	2016.0	2199.4	2381.4	2564.8	2748.2	2931.6	3115.0	3298.4	3481.8	3665.2	4032.0
1500	1178.1	1374.9	1568.2	1767.0	1963.5	2160.0	2356.5	2551.5	2748.0	2944.5	3141.6	3337.5	3534.0	3730.5	3927.0	4320.0
1600	1256.6	1466.5	1672.8	1884.8	2094.4	2304.0	2513.6	2721.6	2931.2	3140.8	3350.4	3560.0	3769.6	3979.2	4188.8	4608.0
1700	1335.2	1558.2	1777.3	2002.6	2225.3	2448.0	2670.7	2891.7	3114.4	3337.1	3559.8	3782.5	4005.2	4227.9	4450.6	4896.0

R.P.M.	DIAMETER OF PULLEY, INCHES															
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
40	....	....	....	....	....	....	....	....	....	....	....	....	251.3	261.8	272.3	282.7
50	....	....	....	....	....	....	....	....	261.8	274.9	288.0	301.1	314.2	327.3	340.4	353.4
60	....	....	....	....	251.3	267.1	282.7	298.4	314.2	329.9	345.5	361.3	377.0	392.7	408.4	424.1
70	....	....	256.6	274.9	293.2	311.6	329.8	348.2	366.5	384.9	403.1	421.5	439.8	458.2	476.5	494.8
80	251.3	272.5	293.2	314.2	335.0	356.1	377.0	397.9	418.9	439.8	460.7	481.7	502.6	523.6	544.6	565.4
90	282.7	306.5	329.9	353.4	376.9	400.6	424.1	447.7	471.2	494.8	518.3	541.9	565.5	589.1	612.6	636.1
100	314.2	340.6	366.5	392.7	418.8	445.1	471.2	497.4	523.6	549.8	575.9	602.1	628.3	654.5	680.7	706.8
110	345.5	374.7	403.2	432.0	460.7	489.6	518.3	547.1	576.0	604.8	633.5	662.3	691.1	720.0	748.8	777.5
120	376.9	408.7	439.8	471.2	502.6	534.1	565.4	596.9	628.3	659.8	691.1	722.5	754.0	785.4	816.8	848.2
130	408.3	442.8	476.5	510.5	544.4	578.6	612.6	646.6	680.7	714.7	748.7	782.7	816.8	850.9	884.9	918.8
140	439.7	476.8	513.1	549.8	586.3	623.1	659.7	696.4	733.0	769.7	806.3	842.9	879.6	916.3	953.0	989.5
150	479.2	510.9	549.8	589.1	628.2	667.7	706.8	746.1	785.4	824.7	863.9	903.1	942.5	981.8	1021.1	1060.2
160	502.6	545.0	586.4	628.3	670.1	712.2	759.3	795.8	837.8	879.7	921.4	963.4	1005.3	1047.2	1089.1	1130.9
170	534.0	579.0	623.1	667.6	712.0	756.7	801.0	845.6	890.1	934.7	979.0	1023.6	1068.1	1112.7	1157.2	1201.6
180	565.4	613.1	659.7	706.9	753.8	801.2	848.2	895.3	942.5	989.6	1036.6	1083.8	1130.9	1178.1	1225.3	1272.2
190	597.8	647.1	696.4	746.1	795.7	845.7	895.3	945.1	994.8	1044.6	1094.2	1144.0	1193.8	1243.6	1293.3	1342.9
200	628.2	681.2	733.0	785.4	837.6	890.2	942.4	994.8	1047.2	1099.6	1151.8	1204.2	1256.6	1309.0	1361.4	1413.6
220	691.0	749.3	806.3	863.9	911.4	979.2	1036.6	1094.3	1151.9	1209.6	1267.0	1324.6	1380.3	1439.9	1497.4	1555.0
240	753.8	817.4	879.6	942.5	1005.1	1068.2	1130.9	1193.8	1256.6	1319.5	1382.2	1445.0	1507.9	1570.8	1633.7	1696.3
260	816.7	885.6	952.9	1021.0	1088.9	1157.3	1225.1	1293.2	1361.4	1429.5	1497.3	1565.5	1633.6	1701.7	1769.8	1837.7
280	879.5	953.7	1026.2	1099.6	1172.6	1246.3	1319.4	1392.7	1466.1	1539.4	1612.5	1685.9	1759.2	1832.6	1906.0	1979.0
300	942.3	1021.8	1099.5	1178.1	1256.4	1335.3	1413.6	1492.2	1570.8	1649.4	1727.7	1806.3	1884.9	1963.5	2042.1	2120.4
320	1005.1	1089.9	1172.8	1256.6	1340.2	1424.3	1507.8	1592.7	1675.5	1759.4	1842.9	1926.7	2010.6	2094.4	2178.2	2261.8
340	1067.9	1158.0	1246.1	1335.2	1423.9	1513.3	1602.1	1691.7	1780.2	1869.3	1958.1	2047.1	2136.2	2225.3	2314.4	2403.1
360	1130.8	1226.2	1319.4	1413.7	1507.7	1602.3	1696.3	1790.6	1885.0	1979.3	2073.2	2167.6	2261.9	2356.2	2450.5	2544.5
380	1193.6	1294.3	1392.7	1492.3	1591.4	1691.4	1790.6	1890.1	1989.7	2089.2	2188.4	2288.0	2387.5	2487.1	2586.7	2685.8
400	1256.4	1362.4	1466.0	1570.8	1675.2	1780.4	1884.8	1989.6	2094.4	2199.2	2303.6	2408.4	2513.2	2618.0	2722.8	2827.2
450	1413.4	1532.7	1649.2	1767.2	1884.6	2003.0	2120.4	2238.3	2356.2	2474.1	2591.6	2709.4	2827.4	2945.2	3063.2	3180.6
500	1570.5	1703.3	1823.5	1963.5	2094.0	2225.5	2356.0	2487.0	2618.0	2749.0	2879.5	3010.5	3141.6	3272.5	3403.5	3534.0
550	1727.5	1873.3	2015.7	2159.8	2504.3	2448.1	2591.6	2735.7	2879.8	3023.9	3167.5	3311.5	3455.8	3599.8	3743.9	3887.4
600	1884.6	2043.6	2199.0	2356.2	2512.8	2670.6	2827.2	2984.0	3141.6	3298.8	3455.4	3612.6	3769.8	3927.0	4084.2	4240.8
650	2043.6	2213.9	2382.2	2552.6	2722.2	2893.2	3062.8	3233.1	3403.4	3573.7	3743.4	3913.6	4084.0	4254.2	4424.6	4594.2
700	2198.7	2384.2	2565.5	2748.9	2931.6	3115.7	3298.4	3481.8	3665.2	3848.6	4031.3	4214.7	4398.2	4581.5	4764.9	4947.6
800	2512.8	2724.8	2932.0	3141.6	3350.4	3560.8	3769.6	3979.2	4188.8	4398.4	4607.2	4816.8	5026.6	5236.0	5445.6	5654.4
900	2826.9	3065.4	3298.5	3534.3	3769.2	4005.9	4240.8	4476.6	4712.4	4948.2	5183.1	5418.9	5654.8	5890.5	....	....
1000	3141.6	3406.0	3665.0	3927.0	4188.0	4451.1	4712.0	4974.0	5236.0	5498.0	5759.0	....	....	....	....	....
1100	3455.1	3746.6	4031.5	4319.7	4606.8	4896.1	5183.2	5471.4	5759.6	....	....	....	....	....	....	....
1200	3769.2	4087.2	4398.0	4712.4	5025.6	5341.2	5654.4	....	....	....	....	....	....	....	....	....
1300	4083.3	4427.8	4764.5	5105.1	5444.4	5786.3	....	....	....	....	....	....	....	....	....	....
1400	4397.4	4768.4	5131.0	5497.8	5863.2	....	....	....	....	....	....	....	....	....	....	....
1500	4711.5	5109.0	5497.5	5890.5	....	....	....	....	....	....	....	....	....	....	....	....
1600	5025.6	5449.6	5864.0	....	....	....	....	....	....	....	....	....	....	....	....	....

of power that the belt can deliver to it. The curves Fig. 3 show the influence of arc of contact upon horsepower transmitted. Table III indicates the arc of contact of the belt on the smaller pulley for the usual range of pulley sizes and center line distances.

Equally or more important than arc of contact is the velocity of the belt. With a given effective pull in the belt, up to the point that centrifugal tension begins to exert an influence, the horsepower transmitted varies directly with the velocity. At a certain point the centrifugal tension begins to appreciably decrease the effective pull, and a still further increase of belt velocity will actually decrease the horsepower transmitted. The rule-of-thumb formulas neglected the effect of centrifugal tension, and indicated that an indefinite increase in velocity increased indefinitely the horsepower transmitted. As a matter of fact, within practical working tensions, the effect of centrifugal tension becomes so great that at velocities in the neighborhood of 6800 ft. per minute the belt will fail to transmit any power whatever. The curves of Fig. 2 show the relation between horsepower transmitted

TABLE IV. (CONT.).—VELOCITY OF BELTS, FEET PER MINUTE

R.P.M.	DIAMETER OF PULLEY, INCHES															
	28	29	30	32	34	36	38	40	42	44	46	48	54	60	66	72
20	....	....	....	....	....	....	....	....	....	....	....	251.3	282.7	314.2	345.6	377.0
30	....	....	....	251.5	267.0	282.8	298.4	314.2	329.9	345.6	361.3	377.0	424.1	471.2	518.4	565.5
40	293.2	303.7	314.2	335.1	356.0	377.0	397.9	418.9	439.8	460.8	481.7	502.6	565.5	628.3	691.2	754.0
50	366.5	379.6	392.7	418.9	445.1	471.3	497.4	523.6	549.8	576.0	602.2	628.3	706.9	785.4	864.0	942.5
60	439.8	455.5	471.2	502.6	534.1	565.5	596.9	628.3	659.7	691.1	722.6	754.0	848.2	942.5	1036.7	1130.9
70	513.1	531.4	549.8	586.4	623.1	659.7	696.4	733.0	769.7	806.3	843.0	879.6	989.5	1099.6	1209.5	1319.4
80	586.4	607.4	628.3	670.2	712.1	754.0	795.8	837.8	879.6	921.5	963.4	1005.3	1131.0	1256.6	1382.3	1507.9
90	659.7	683.3	706.9	753.9	801.1	848.3	895.3	942.5	989.6	1036.7	1083.9	1130.9	1272.3	1413.7	1555.1	1696.4
100	733.0	759.2	785.4	837.7	890.1	942.5	994.8	1047.2	1099.5	1151.9	1204.3	1256.6	1413.7	1570.8	1727.9	1884.9
110	806.3	835.1	863.9	921.5	979.1	1036.8	1094.3	1151.9	1209.5	1267.1	1324.7	1382.3	1555.1	1727.9	1900.7	2073.4
120	879.6	911.0	942.5	1005.2	1068.1	1131.0	1193.8	1256.6	1319.4	1382.3	1445.2	1507.9	1696.4	1885.0	2073.5	2261.9
130	952.9	987.0	1021.0	1089.0	1157.1	1225.3	1293.2	1361.4	1429.4	1497.5	1565.6	1633.6	1837.8	2042.0	2246.3	2450.4
140	1026.2	1062.9	1099.6	1172.8	1246.1	1319.5	1392.7	1466.1	1539.3	1612.7	1686.0	1759.2	1979.2	2199.1	2419.1	2638.9
150	1099.5	1138.8	1178.1	1256.6	1335.2	1413.8	1492.2	1570.8	1649.3	1727.9	1806.5	1894.9	2120.6	2356.2	2591.9	2827.4
160	1172.8	1214.7	1256.6	1340.3	1424.2	1508.0	1591.7	1675.5	1759.2	1843.0	1926.9	2020.6	2261.9	2513.3	2764.6	3015.8
170	1246.1	1290.6	1335.2	1424.1	1513.2	1602.3	1691.2	1780.2	1869.2	1958.2	2047.3	2146.2	2403.3	2670.4	2937.4	3204.3
180	1319.4	1365.6	1413.7	1507.9	1602.2	1696.5	1790.6	1885.0	1979.1	2073.4	2167.7	2261.9	2544.7	2827.4	3110.2	3392.8
190	1392.7	1442.5	1492.3	1591.6	1691.2	1790.8	1890.1	1989.7	2089.0	2188.6	2288.2	2387.5	2686.0	2984.5	3283.0	3581.3
200	1466.0	1518.4	1570.8	1675.4	1780.2	1885.0	1989.6	2094.4	2199.0	2303.8	2408.6	2513.2	2827.4	3141.6	3455.8	3769.8
220	1612.6	1670.2	1727.9	1842.9	1958.2	2073.5	2188.6	2303.8	2418.9	2534.2	2649.5	2764.5	3110.1	3455.8	3801.4	4146.8
240	1759.2	1872.1	1885.0	2010.5	2136.2	2262.0	2387.5	2513.3	2638.8	2764.6	2890.3	3015.8	3392.9	3769.9	4147.0	4523.8
260	1905.8	1973.9	2042.0	2178.0	2314.3	2450.5	2586.5	2722.7	2858.7	2994.9	3131.2	3267.2	367.6	4084.1	4492.5	4900.1
280	2052.4	2125.8	2199.1	2345.6	2403.2	2639.0	2785.4	2932.2	3078.6	3225.3	3372.0	3518.5	3958.4	4398.2	4838.1	5277.7
300	2199.0	2277.6	2356.2	2513.1	2670.3	2827.5	2984.4	3141.6	3298.5	3455.7	3612.9	3769 8	4241.1	4712.4	5183.7	5654.7
320	2345.6	2429.4	2513.3	2680.6	2848.3	3016.0	3183.4	3351.0	3518.4	3686.1	3853.8	4021.1	4523.8	5026.6	5529.3	....
340	2492.2	2581.3	2670.4	2848.2	3026.3	3204.5	3382.3	3560.5	3738.3	3916.5	4094.6	4272.4	4806.6	5340.7	....	....
360	2638.8	2733.1	2827.4	3015 7	3204.4	3393.0	3581.3	3770.0	3958.2	4146.8	4335.5	4523.8	5089 3	5654.9	....	....
380	2785.4	2885.0	2984.5	3183.3	3382.4	3581.5	3780.2	3979.4	4178.1	4377.2	4576.3	4775.1	5372.1	....	....	....
400	2932.0	3036.8	3141.6	3350.8	3560.4	3770.0	3979.2	4188.8	4398.0	4607.6	4817.2	5026.4	5654.8	....	....	....
450	3298.5	3416.4	3534.3	3769.6	4005.4	4241.2	4476 6	4712.4	4947.8	5183.5	5419.4	5654.7	....	....	....	....
500	3665.0	3796.0	3927.0	4188.5	4450.5	4712.5	4974.0	5236.0	5497.5	5759.5	....	....	....	....	....	....
550	4031.5	4175.6	4319.7	4607.3	4895.5	5183.7	5471.4	5759.6	....	....	....	....	....	....	....	....
600	4398.0	4555.2	4712.4	5026.2	5340.6	5655.0	....	....	....	....	....	....	....	....	....	....
650	4764.5	4934.8	5105.1	5445.0	5785.6	....	....	....	....	....	....	....	....	....	....	....
700	5131.0	5314.4	5497.8	5863.9	....	....	....	....	....	....	....	....	....	....	....	....
750	5497.5	5694.0	5890.5	....	....	....	....	....	....	....	....	....	....	....	....	....
800	5654.4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

and belt velocity, while those in Fig. 1 show the horsepower transmitted according to Barth's formulas, on which the tables are based, Nagle's formula and some of the more common rules-of-thumb. Table IV gives the belt velocity obtained by a varying number of revolutions per minute of the usual range of pulley sizes.

USE OF THE BELTING TABLES

Having determined the arc of contact of the belt on the smaller pulley, and the velocity, the horsepower that will be transmitted can be read directly from the proper section of Table I. In the third and seventh columns of the table will be found the tension per square inch of cross-section under which machine and countershaft belts respectively should be put on the pulleys, while the fourth and eighth columns show the tensions below which they should not be allowed to fall in service. The use of the tables presupposes that the belts will be subjected to regular inspection and measurement of tension to make sure that the belts in service do not fall below these minimums.

The tables are calculated for belts of 1 sq. in. of cross-section, but the figures can be adapted to belts of any size by means of the constants in Table II, which show the relative cross-sectional area of belts of different widths and thicknesses. As the horsepower transmitted under a given set of conditions varies with the cross-sectional area, a simple multiplication of the figures given in Table I by the proper constant as given in Table II will give the desired result. The same statement applies to the tension values. Multiplying the values given in Table I for the initial and minimum tensions will give the total tension under which the belt under consideration should be put up, and also the total tension below which it should not be allowed to fall in service.

The following examples will make clear the use of the tables:

I. The three steps of a lathe cone pulley have diameters respectively of 14, 16 and 18 in. and a uniform face of 5 in. The countershaft cone has the same diameters, and rotates at 110 r.p.m. The distance between the center lines of the machine spindle and the countershaft is 8 ft. What size of belt will be necessary to deliver 3 hp. at the machine cone, with the belt on the largest step of the machine cone, and what horsepower will be delivered by it when it is on the smallest step of the machine cone?

The difference in diameter of the largest and smallest cone steps is 4 in. Referring to Table III, we find that for a center line distance of 8 ft., a 4-in. difference in diameter will give an arc of contact of the belt on the smaller pulley of 178 deg., which for all practical purposes we can regard as 180 deg.

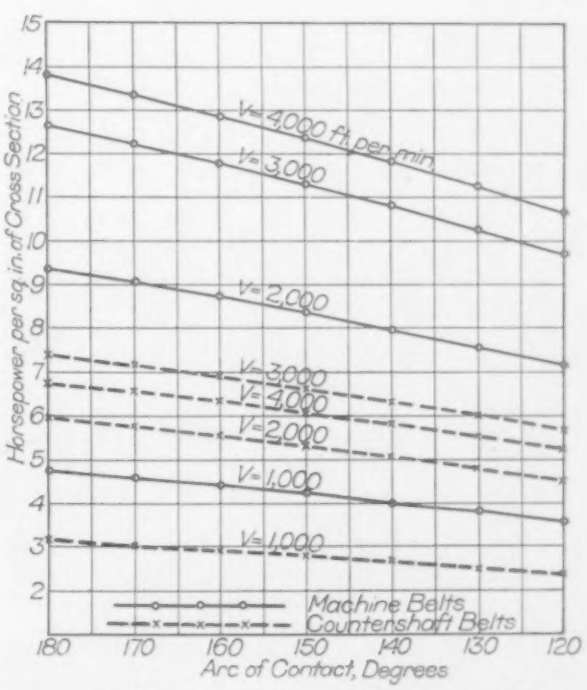


Fig. 3—Relation Between Arc of Contact and Horsepower Transmitted by Machine and Countershaft Belts

Table IV shows that a 14-in. pulley at 110 r.p.m. will give a belt velocity of 403.2 ft. per minute. Turning now to Table I, we find in the section headed "180 deg. arc of contact" that a belt of 1 sq. in. cross-sectional area will transmit 1.05 hp. at 250 ft. per minute, and 2.27 hp. at 500 ft. per minute. The power transmitted at speeds intermediate to those given in the tables increases very nearly in proportion to the increase in the speed. The difference in speed between 250 ft. and 403 ft. per minute is 153 ft. per minute, and between 250 ft. and 500 ft. per minute is 250 ft. per minute. The difference in horsepower transmitted at 250 ft. and 500 ft. per minute is 1.22 hp. Therefore at 403 ft. per minute the horsepower transmitted would be

$$1.05 + \left(1.22 \times \frac{153}{250}\right)$$
$$= 1.05 + (1.22 \times 0.612) = 1.79 \text{ hp.}$$

As it is desired to transmit 2 hp., the cross-sectional area of the belt will be $3 \div 1.79 = 1.676$ sq. in. The width of belt that should be used on a cone pulley of 5-in. face should not exceed 4½ in., and we therefore look in Table II opposite 4½ for the figure most nearly corresponding to 1.676. This we find to be 1.719, under ⅜ in. Therefore, a belt 4½ x ⅜ in. will be ample to transmit the required horsepower. It should be put on the pulleys under a total initial tension (see column 3, Table I) of

$$1.719 \times \left(183.75 - (183.75 - 180.25 \times \frac{153}{250})\right)$$
$$= 1.719 \times 181.61 = 312 \text{ lb. approx.}$$

By the same sort of calculation we find from column 4 of the table that the belt should be taken down and retightened when its total tension is 215 lb.

To find the horsepower that the belt will transmit when it is on the smallest step of the machine cone, we ascertain from Table IV its velocity, which in this case will be that of an 18-in. pulley at 110 r.p.m., or 518.3 ft. per minute, which we can consider as 500 ft. The arc of contact will be the same as before, and can again be taken as 180 deg. From Table I we see that the horsepower transmitted by a belt of 1 sq. in. cross-sectional area is 2.27, and multiplying this figure by the area of the belt in question, 1.719, we obtain as the horsepower transmitted 3.9.

II. A 25-hp. motor is located in the roof trusses of a machine shop, driving the shafting for a group of machines. The motor has a speed of 1100 r.p.m., the motor pulley being 9-in. diameter and 9-in. face. The motor frequently is required to carry an overload of 10 per cent, or a total load of 27.5 hp. The center line distance between the motor and line shaft is 18 ft. The line shaft pulley is 30 in. diameter. The present belt is 8 in. wide and 7/16 in. thick. Is it heavy enough for the load, and if not, what size of belt should be used? At what tension should the belt be put up, and at what tension should it be retightened?

As the belt is in an inaccessible position, the figures in the countershaft section of Table I will apply. From Table III the arc of contact is 172 deg. and the answer to our questions will therefore be found in the section of Table I headed "170 deg. arc of contact." From Table IV the velocity is ascertained to be 2591.3 ft. per minute. Inasmuch as we actually have a larger arc of contact than 170 deg., we can assume the velocity to be slightly lower and read the horsepower directly from the table (column 6) as 6.66 opposite the velocity 2500 ft. per minute for a belt of 1 sq. in. of cross-sectional area. The total power to be transmitted is 27.5, and therefore a belt of $27.5 \div 6.66 = 4.129$ sq. in. cross-sectional area will be necessary.

In Table II, under 7/16 in. thickness we find the value 3.5 opposite 8 in. width, and therefore the belt at present in use is too small, and if used will require retightening at shorter intervals than are desirable, due to the necessity of running it under higher initial tensions than are consistent with good practice. If we desire to use the same width of belt, which is quite as wide as should be used on a pulley of 9 in. face, we must increase its thickness Table II shows that an 8 x ½-in. belt will have an area of 4 sq. in., and an 8 x 9/16-in. belt will have an area of 4.5 sq. in., and as the former will transmit without trouble $6.60 \times 4 = 26.64$ hp., it can be safely used without increasing the tensions given in the table to any degree. It might perhaps be advisable to retighten the belt at a slightly higher figure than that given in the table as the minimum tension. Assuming the 8 x ½-in. belt to be used, the tension at which it should be put on the pulleys (column 7, Table I) will be $4 \times 142 = 568$ lb., and the tension at which it should be retightened (column 8, Table I) $4 \times 85.5 = 342$ lb., or to be on the safe side, 350 lb. total tension.

OBJECT OF THE TABLES AND FORMULAS

The argument may be advanced that the values given in the tables call for heavier belts and lower tensions than are the usual practice. The answer to this is that that is precisely what they are intended to do. The object of the formulas and practice of Barth, which are based on the nine years of experiment by Taylor, is not to find the smallest belt which will transmit a given horsepower. It is rather to find the belt which under the specified conditions of service will not only transmit the desired power but will give the best service and in the long run cost the least for repairs and maintenance, and insure the longest life of belt. In doing this, the total cost of belting will be far less than if the short-sighted policy of light belts and high tensions is adopted. Furthermore, the adoption of the Barth practice will insure an almost absolute freedom from belt breakdowns, and the loss, due to stoppage of production, caused by a single belt breakdown may far exceed the difference in cost between the light belt and the heavier one that would have avoided the trouble. It is poor economy to attempt to save money by skimping the belting.

THEORY OF BELTING PRACTICE

As the theory on which the tables are based is elaborately explained by Mr. Barth in his paper entitled "The Transmission of Power by Leather Belting," presented before the American Society of Mechanical Engineers in January, 1909, no attempt will be made here to discuss it except to present the formulas involved, together with the briefest possible explanation of them.

The starting point of Mr. Barth's theory is the discarding of the commonly held but erroneous assumption that the sum of the tensions in the two sides of a running belt is constant. In place of this he has proved the theorem that the sum of the square roots of the tensions in the two strands of the belt remains constant. From this assumption, he has by a process of mathematical reasoning derived the formulas given below, the correctness of which has been amply substantiated in practice. Another common assumption proved erroneous is that the coefficient of friction between the belt and pulley is constant at all velocities of the belt. An expression showing the relation of the coefficient of friction to the velocity of the belt has been derived, according to which the coefficient increases as the velocity arises. The periods at which belts run-

ning at different speeds will require retightening will be nearly constant if they are all made to do their work at such initial tensions as under full load will result in the same sum of the tension in the tight side and one-half the tension in the slack side at the two extremes of the initial tensions, just before and just after retightening. This condition will be expressed by the equation

$$t_1 + \tfrac{1}{2}t_2 = A = \text{a constant}$$

The uniform period of use before retightening is a highly desirable condition of shop operation.

In the formulas below the following notation is used:

t_o = minimum initial tension, lb., to which belt can be allowed to fall in service.
t_m = maximum initial tension, lb., to which belt is retightened.
t_1 = tension in tight strand of running belt.
t_2 = tension in slack strand of running belt.
p = effective pull in the running belt, lb. $= t_1 - t_2$.

The above values are all per sq. in. of cross-section.

ϕ = coefficient of friction between the belt and the pulley.
a = arc of contact of belt on pulley, in radians $= 0.017453$ arc in deg.
V = velocity of belt, ft. per min.
e = basis of the Naperian system of logarithms $= 2.71828$.
A = a constant. For machine belts and other belts readily accessible $A = 240$; for countershaft belts or inaccessible belts $A = 160$.

The effective pull of a belt is determined by the formula

$$p = \frac{(e^{\phi a} - 1)\ (2A - 0.00001036V^2)}{2e^{\phi a} + 1} \qquad [1]$$

The horsepower is calculated from the effective pull by means of the formula

$$\text{Hp.} = (p \times V) \div 33000 \qquad [2]$$

If it is desired to know the tensions in the tight and slack sides of the running belt, these can be arrived at by the following formulas:

$$t_1 = \frac{2A + p}{3} \qquad [3] \qquad t_2 = \frac{2\ (A - p)}{3} \qquad [4]$$

The formula of greatest value to the belt user is that for the minimum and maximum allowable initial tensions in the belt. This determines the tension under which the belt should be put on the pulleys in order to give the greatest satisfaction, and the tension below which it should not be allowed to fall in service if it is to transmit the desired horsepower. This formula is

$$t_o = \frac{4A - p + \sqrt{(4A - p)^2 - 9p^2}}{12} \qquad [5]$$

The use of this formula as it stands, using as values of A 240 or 160 for machine and countershaft belts respectively, will give the minimum initial tension, or tension in the belt at rest, below which the belt should not be allowed to fall, and the point at which it should be retightened. By making $A = 320$ lb. for machine belts and $A = 240$ lb. for countershaft belts, this formula will give the maximum initial tension, t_m, to which the belt should be retightened, and the tension at which it should be started in service when it is first put on the pulleys.

In using formula (1) to determine values of p, it will be found more convenient if for the expression $e^{\phi a}$, the expression $10^{0.00758\phi c}$ is substituted, c being the arc of contact in degrees.

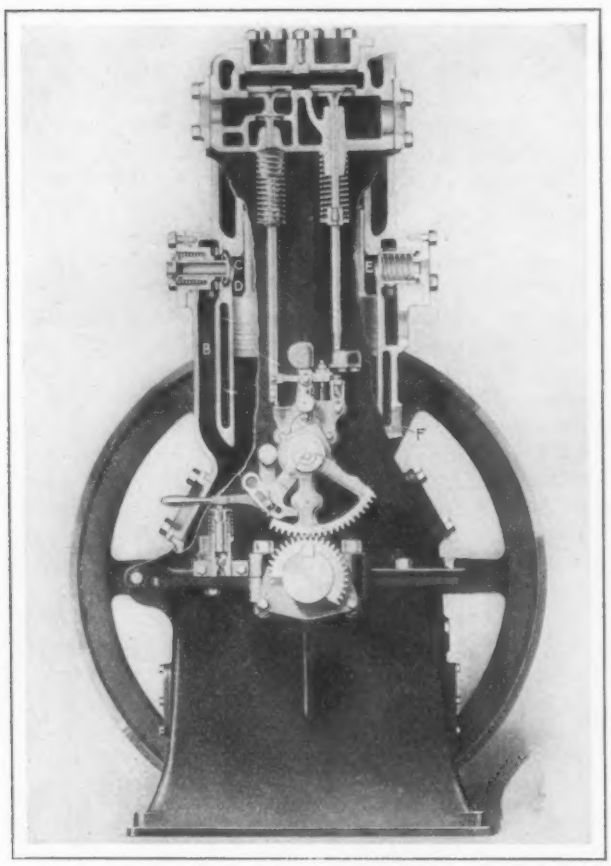
The use of the formulas is simple, and requires no higher mathematical ability than that of facility in handling a table of logarithms. The process, however, is tedious and the determination of the horsepower and tensions involves a great number of separate computations, and would be impractical were there many belts in question. In his paper, before mentioned, Mr. Barth prepared a series of graphical charts which contained the solution of the equations. He has also developed a slide rule in which are embodied all the variables enumerated above, and which offers a means of solving rapidly the greater number of belt problems within the usual shop range. The charts, however, are difficult to understand and are not readily followed by the average person. Furthermore, it is exceedingly difficult to read them closely enough to be sure of exact results. The slide rule is far superior to the charts, but, again, many persons find difficulty in handling the ordinary slide rule, to say nothing of the more complicated belt-slide rule with its multiplicity of slides. For these reasons it has been considered wise to calculate the accompanying tables, which contain all the information embodied in the slide rules, and present it in a form that may be readily used by a person of even less than average ability.

VERTICAL AIR COMPRESSOR

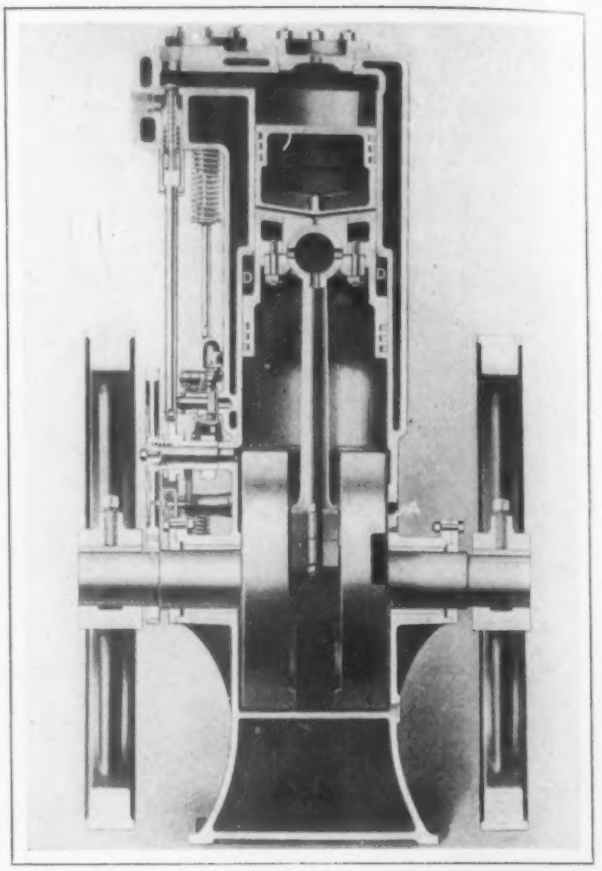
Two-Stage Unit Combining Both Power and Air Cylinders in One Casting

The Lyons Atlas Company, Indianapolis, Ind., has placed on the market a portable self-contained two-stage vertical air compressor driven by an internal combustion engine. It is built in capacities ranging from 35 to 150 cu. ft. per minute with a maximum pressure of 200 lb. Although the compressor illustrated is of the stationary type, a truck mounting may be used. The compressor is characterized by a small number of moving parts; the absence of stuffing boxes, piston rods and governor belts; the provision of large cooling surface per unit of cylinder volume and the locating of all the working parts either in plain sight or within easy reach from the outside of the compressor. By removing the holding-down bolts between the base and the frame and disconnecting the pipe on one side of the engine, the frame may be swung back on the hinges to give access to the crankcase for inspection and adjustment.

The compressor consists of a two-stage direct driven air compressor combined with a four-cycle single-acting vertical internal combustion engine, so as to make the power and the air cylinders one continuous casting requiring only a single differential piston, one connecting rod and one crank. The engine, which runs in a clockwise direction when viewed from the governor side, as in one of the accompanying illustrations, can be started by hand or by air which has been previously compressed and stored in a receiver or pressure tank. The speed regulation is provided by an inertia weight pivoted to the bellcrank carrying the exhaust roller. As the speed rises above the normal rate, the weight hangs back, thus placing a spring under tension. This stressing of the spring is relied upon to keep the suction valve closed and the exhaust valve open during the suction stroke until such time as the speed decreases when the spring relaxes and the regular cycle of operations is resumed. The inertia required to enable a hit and miss governing device to maintain a constant speed regardless of the fact that there are two air compressing strokes for each



View Partly in Section of the Compressor from the Governor Side of the Engine



Sectional Elevation Along the Cylinder Center Line of a Gasoline Engine Driven Two-Stage Air Compressor

working stroke of the engine, is provided by two heavy flywheels and crank disks which practically fill the crankcase and reduce clearance.

The fuel used by the engine is gasoline but the engine may be arranged to take kerosene or natural, illuminating or producer gas. A sight feed cylinder lubricator is relied upon to serve both ends of the stepped piston, a peripheral groove gathering the surplus oil fed by the lubricator and delivering it through drilled holes to the upper and lower bearings of the connecting rod. Grease cups are provided for the crankshaft bearings and are relied upon to provide an air seal.

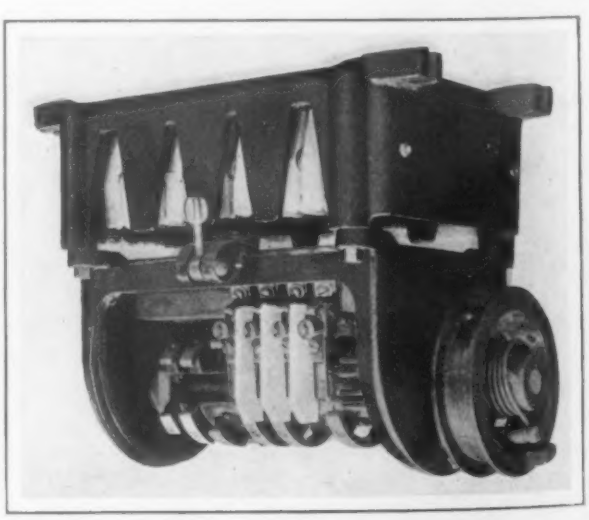
The final pressure, which is either 100 or 200 lb., is reached through two stages of compression. When the air piston is at the top of the stroke, the crankcase is full of air at atmospheric pressure admitted through the port *A*, which registers with a port in the nearest crank disk. As the piston travels downward, this air is compressed in the crankcase after which it flows through the passage *B* and the valve *C* into the annular chamber *D* and raises the absolute pressure there to approximately 20 lb. As the piston starts on the upward stroke, the valve *C* closes, and when the pressure in the annular space *D* equals that of the receiver, the discharge valve *E* opens and permits the air to pass into the receiver during the remainder of the upward stroke. This pressure is relied upon to assist the piston on the upward stroke, and it is emphasized that the location of the port in crank disk is such that the port *A* will not open until atmospheric pressure is reached.

The circulating water used is taken through the opening *F* at the bottom of the air cylinder jacket and passes upward and entirely around the air cylinder, thus absorbing the heat of compression. In this way, it is pointed out that when the water passes from the air cylinder jacket to that of the power cylinder its temperature has been increased sufficiently to maintain a high thermal efficiency throughout the combined cycle.

An unloading device can be furnished at an extra cost to open the air admission valve between the crankcase and the annular chamber *D* when the pressure reaches a predetermined point. In this way, it is emphasized, the load is removed from the engine, which is permitted to run light until the pressure is reduced below the maximum for which the unloading device has been set.

Crane Controller Operated by a Rope

The Cutler-Hammer Mfg. Company, Milwaukee, Wis., has recently added a reversible drum type to its crane and hoist controller line. It is designed for intermittent speed regulating duty, such as is met with in crane and hoist service and is intended for overhead mounting indoors. The control is by a rope passing over the sheave at the right of the controller.



A New Type of Crane and Hoist Controller Operated from the Floor by a Rope

Two types are ordinarily made: one to provide a 50-per-cent reduction in the speed with only half the full-load current, is designed for general crane and hoist duty. Wherever the average load has to be handled by the crane at a steady slow speed, as is the case in foundries, the builder recommends the use of the second type, which will reduce the speed 90 per cent under light-load conditions.

Keyless Lock Labor Decision Reversed

The Indiana Supreme Court has reversed the lower court's decision in the case of the Keyless Lock Company, Indianapolis. The trial court had decided against the members and officers of three lodges of the Iron Molders' Union, enjoining the union from picketing and from otherwise hampering the company's plant to unionize it, and awarding judgment for $6,000 damages. The reversal is because of the erroneous admittance of evidence by the court over objections by the defendants. The higher court says that it was error to admit in evidence a resolution introduced by one of the defendants in the international body reflecting against courts and governmental officers and not adopted by the association; that it was error to admit evidence outside the issues prejudicing a party; that it was error to admit statements of a telephone conversation with a strike-breaker, who was hired and, after leaving the shop, telephoned he would not return, as it was not *res gestae*, and that it was error to admit the statement that the business had been interfered with, as it was a conclusion of one of the ultimate facts in issue.

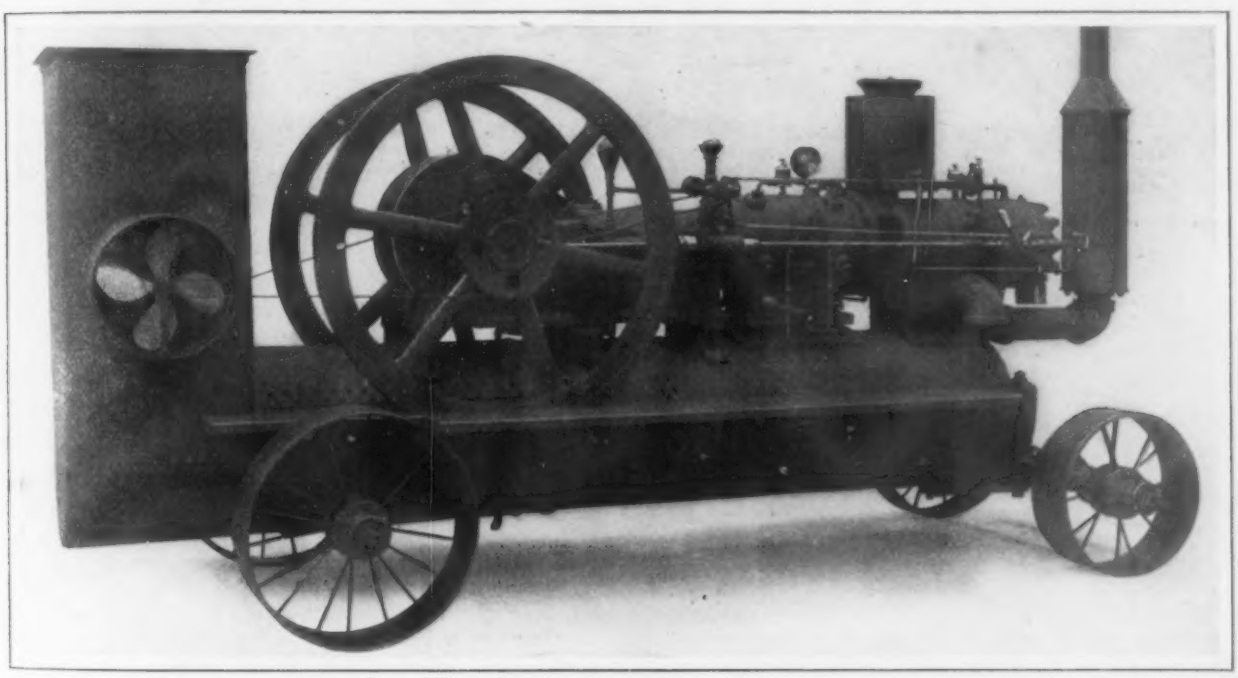
The Supreme Court says it approves the doctrine of the right of any number of persons to do that which is lawful for one person to do, and that members of labor unions may peaceably combine to better their condition, as against the idea that there may be an unlawful combination to do that which is lawful for an individual to do. The court holds that there was some evidence of violence by the defendants and that, as there was no motion to modify the judgment, the judgment would stand had there not been error in the conduct of the trial.

The original decision in this case was set forth in THE IRON AGE of July 17, 1913. The Keyless Lock Company was operating an open shop and the Iron Molders' Union engineered a strike to force its unionization. The union had at first endeavored to get the company to force its non-union employees to join the organization by threatening them with dismissal if they refused. It does not appear that the question of wages was in any way involved.

Fuel-Oil-Engine-Driven Air Compressor

An air compressor said to be capable of operating on the lowest grades of fuel distillates has been placed on the market by the Chicago Pneumatic Tool Company, Fisher Building, Chicago, Ill. It is of the standard horizontal type of construction and is built in stationary and portable styles, the latter having either a tank mounting, as illustrated, or being furnished with skids. Both single and duplex machines are built and the special feature aside from the ability to burn cheap grades of fuel is the use of the builder's flat disk valves.

The compressors are of the straight line type with the air cylinder bolted to the main frame and connected in tandem to the power end. The power cylinders are of the valveless, two-cycle, low-compression type, ignition being secured by a hot plate system at the end of the compression stroke the same as in a Diesel engine. A small oil pump injects the fuel against the hot plate on the piston as it approaches the end of the compression stroke, and it is emphasized that the combustion is so complete that when the exhaust port is opened the fuel loss is negligible. This can also be reduced by using water with the oil, the exact amount admitted to the combustion chamber being controlled by a flyball governor. The single compressors have six standard lengths of stroke ranging from 8 to 21 in. and the smaller sizes can be tank mounted as shown, or set on skids, while the larger ones are designed for stationary use only.



A Portable Air Compressor Arranged with the Receiver Tank Underneath and the Fuel Oil Engine Which Drives It Mounted at the End

Among the uses to which these compressors may be put are the pumping of oil and water by various systems in industrial plants, and for use wherever compressed air produced at a low figure can be utilized. In tests made of these compressors, it has been found possible to compress air to 100-lb. pressure at a cost of 56c. per 9-hr. day for each 100 cu. ft. of free air delivered every minute to the receiver, this figure being based on the use of fuel at 3c. per gallon. The fuel used by these comprssors is any mineral oil of 26 deg. Beaume scale or lighter, containing not over 1 per cent sulphur.

Bills are pending at the present time in New York, New Jersey and Virginia looking to the establishment of a law based on the American Society of Mechanical Engineers' boiler code, and according to Thomas E. Durban, Erie, chairman of the administrative council of the American Uniform Boiler-Law Society, bills may shortly be introduced into Maryland and Rhode Island legislatures.

The Composition of Some German Shells

Influence of Various Elements on the Physical Properties—Phosphorus and Sulphur Limits—Mechanical and Chemical Testing

German shells in large quantities were thrown on the northeast coast of England on Dec. 16, 1914, by German war vessels which made a raid at that time. Many members of the Cleveland Institution of Engineers secured fragments of these shells for determining their composition. Dr. J. E. Stead assembled these analyses and presented the results with his comments and conclusions in a paper before that society on Jan. 10, 1916, an abstract of which is as follows:

The pieces analyzed in most cases were small fragments, and it was consequently impossible to judge of the dimensions of the shells of which they formed a part. Judging from information received from Hartlepool and other places, it is certain that there were shells of many sizes—from 11.2-in. armor-piercing shells down to 4-in. high-explosive shells. Many of the larger shells had not burst and it was possible to measure them. Shrapnel shells do not appear to have been used.

Table of Analyses of High-Explosive German Shells

Where Found	No.	Carbon, Per Cent	Manganese, Per Cent	Silicon, Per Cent	Sulphur, Per Cent	Phosphorus, Per Cent	Per Cent Copper,	Tenacity
West Hartlepool..	1	0.60	0.73	....	0.062	0.085	....	..
West Hartlepool..	2	0.70	0.80	0.35	0.027	0.043	....	55
West Hartlepool..	3	0.670	0.515	0.336	0.037	0.048	0.083	62
West Hartlepool..	4	0.870	1.094	0.252	0.037	0.028	0.080	65
West Hartlepool..	5	0.465	0.794	0.324	0.038	0.028	0.090	55
West Hartlepool..	6	0.600	0.655	0.597	0.046	0.051	....	..
West Hartlepool..	7	0.820	1.266	0.186	0.048	0.052	....	..
West Hartlepool..	8	0.765	0.655	0.364	0.030	0.045	....	..
West Hartlepool..	9	0.630	0.550	0.400	0.042	0.077	....	..
West Hartlepool, 8-in. shell.....	10	0.86	1.03	0.186	0.053	0.045	....	..
West Hartlepool..	11	1.12	1.00	0.23	0.054	0.038	....	..
Whitby and Scarbro'	12	0.850	1.330	....	0.080	0.105	....	..
Whitby and Scarbro'	13	0.60	1.21	0.334	0.071	0.069*	....	59
Whitby and Scarbro'	14	0.74	1.170	0.261	0.044	0.064	....	62
Dunkirk	15	0.675	0.380	0.078	0.083	0.043	....	..
Ypres	16	0.700	1.108	0.221	0.041	0.079	....	..
Flanders	17	0.98	1.05	....	0.055	0.086	....	..
Flanders	18	0.93	0.98	....	0.059	0.065	....	..
Flanders	19	0.74	0.98	....	0.054	0.050	....	..
Germany	20	0.393	1.400	0.210	0.035	0.041	....	..
France	21	0.930	0.970	0.164	0.032	0.048	....	..

*Nitrogen = 0.0112 per cent.

The shells used may be divided into two classes, armor-piercing shells and high-explosive shells. The armor-piercing shell fragments were easily detected by the presence of nickel and chromium—elements universally added to steel used in that connection. It may be noted that the Germans affixed to the armor-piercing shells the soft-nose pieces which are invariably used with shells of this description. The analyses of fragments of these shells were made by F. Saniter, and were as follows: Iron (by difference), 91.862 per cent; carbon, 0.840 to 0.50 per cent; manganese, 0.381 per cent; silicon, 0.401 to 0.42 per cent; sulphur, 0.033 to 0.028 per cent.; phosphorus, 0.032 per cent; nickel, 3.100 per cent; chromium, 3.351 per cent. The several analyses and their sources are given in the table.

PHYSICAL APPEARANCE OF THE FRAGMENTS

Most of the fragments examined were small, and the fractures generally indicated material of very high tenacity. There were a few large pieces and these had a much coarser crystalline structure than the smaller ones. It is well known that the appearance of the fractured surfaces of metals broken by sudden shock is a very useful guide in forming a correct judgment of the physical character of the material. If the surfaces are more or less coarsely granular and the fracture has traveled in straight planes, the material is usually relatively weak. Such fractures somewhat resemble the fractures of lump sugar. If they are more finely granular the surfaces are not usually flat and frequently have tongues or pointed strips of metal attached to the fracture, suggesting a tearing action and tough material.

Some of the inner and outer surfaces of the shell fragments were fissured by a multitude of fine cracks, generally parallel to the vertical axis of the shell. The flat surfaces of one of the base plugs where it came into contact with the explosive charge were similarly broken up into fissures, but these did not extend to the outside of the plug. The force must have been of such violence as to tend to tear the metal to pieces and produce disintegration.

One writer, in describing the German shell fragments, said: "One can have little conception of the terrible nature of these until they are handled. They bristle all over with horrible points and edges—some as keen as a razor." One peculiarity is the manner in which the fragments broke, leaving what may be described as "sheer fractured surfaces," with sharp knife-like terminations. The tracks of the fractures were often at angles of 35 to 45 deg. to tangents of the shells, and the broken surfaces of many of them had a somewhat fibrous appearance, characteristic of great toughness. Tests made on the fragments of both the coarsely granular and fibrous varieties confirmed the conclusion that the former were brittle and the latter extremely tough.

THE PRESENCE OF NITROGEN

The fragment corresponding to analysis No. 13 in the table was particularly interesting. It had "sheer fractures" on both its sides, was of fine crystalline structure, and evidently ideal in its character, yet this contained about 0.07 per cent sulphur, and the same amount of phosphorus. Moreover, it contained 0.011 per cent nitrogen, an indication that it was made by the Bessemer process, for no open-hearth steel, so far as is known, contains nearly so much of that element. As acid-Bessemer converters are rare if not non-existent in Germany, it is justifiable to conclude that the steel is basic-Bessemer. It had a fine microstructure with practically no free ferrite, due to the exceedingly high manganese content. In metallographical terms the steel was sorbitic, consisting of unsegregated pearlite. On reheating to about 800 deg. C., and cooling in about half an hour to 400 deg. C., and then to 15 deg. C., its original structure and hardness were reproduced. The Brinell hardness number was 255, equal to about a tenacity of 56 to 57 tons per square inch. What the elongation was could not be determined, but it certainly would not exceed 12 per cent.

Little comment is necessary on the armor-piercing shells. A broken piece from the point was exceedingly hard, as indicated by the Brinell machine. The shell had evidently exploded on coming into contact with something not hard enough to damage the point itself.

VARIATIONS IN COMPOSITION

On examining the analyses of the high-explosive shells one cannot help being struck with the very wide range in the composition. Comparing the maximum and minimum amount of each element, we have: Carbon, 0.393 to 1.12 per cent; manganese, 0.380 to 1.40 per cent; silicon, 0.078 to 0.597 per cent; sulphur, 0.027 to 0.083 per cent; phosphorus, 0.028 to 0.105 per cent. Out of the twenty-one analyses, ten show more than 1 per cent manganese, seven show more than 0.3 per cent silicon, twelve more than 0.2 per cent silicon, three show more than 0.07 per cent sulphur, eight more

than 0.06 per cent phosphorus. The average percentage of carbon is 0.75 per cent.

What is the reason for these great variations? One cannot, of course, say with certainty, but there are only two explanations one can offer:

1. That the German authorities have been careless in their selection of the steel; that the occasional premature bursting of a shell in a gun and the consequent destruction of the gun and the gunners did not matter, as they had so many guns and men to spare—a suggestion actually made in this country, but which is obviously absurd. 2. That the German experts have found that, provided the steel is suitable for the purpose required, a great latitude in the composition and physical properties is permissible.

The first hypothesis may be dismissed without much consideration; the shells sent into our towns, varying greatly in composition, obviously did not burst in the gun. An examination of the larger fragments of German shells did not lead to the discovery of anything in the nature of rokes or surface flaws, and the very high percentage of silicon and manganese in most of them suggests that soundness was considered as of primary importance. The fact that nitrogen was found in a relatively large quantity in one of the best specimens leads to the conclusion that nitrogen is not harmful and that probably basic-Bessemer steel has been found quite suitable, provided a sufficient quantity of silicon and manganese is present to insure soundness.

THE STRESSES ON A SHELL

Any intelligent person with no engineering or special knowledge of the subject would tell us at once that the stresses put on a shell in the gun are compressive, not tensional. That if the shell were made of lead instead of steel the sudden compressive force applied to the base would cause the shell walls to bulge outward and to become reduced in length, and that very soft steel would probably behave in the same manner. Therefore, the Germans were careful to avoid this and made steel strong enough to resist deformation by compression in the guns.

We may conclude, therefore, that what was feared was bulging more than breakage by shock. It cannot be denied by anyone who knows that steel containing 0.75 per cent carbon and above 1.2 per cent manganese is brittle to shock, and that if such material were made into a rail and were tested in the usual way, it would fly to pieces under a falling-weight test, yet steel shells of that description did not burst in the German guns, but burst on us. Every rail-maker knows that a shell containing 0.10 per cent sulphur and phosphorus, 0.45 per cent carbon, and 0.8 per cent manganese would be less liable to break under shock than such steel if sulphur and phosphorus were entirely absent.

MECHANICAL VERSUS CHEMICAL TESTING

The analyses of the German shells naturally make us question our own practice and specifications, which lead to the rejection of material such as would be accepted in Germany. Our authorities may have proofs I do not know of justifying their specifications, but to say that because a shell has burst in a gun, therefore the steel is at fault, is not justifiable; neither is it justifiable to form any dogmatic conclusion without ample proof. One method of testing shells gives conclusive proof that steel of a certain origin, which is not at present admitted by our authorities, is quite suitable for high-explosive shells. Further trials are projected which it is proposed to ask some of the gentlemen responsible for our specifications to attend and witness. One thing which must be admitted is that if a steel is proved by suitable mechanical testing to be satisfactory, on no account should it be rejected on chemical analyses, for one remembers that mechanical testing is the base on which rests all chemical specification.

CONCLUSIONS

In conclusion, judging from the analyses of the German shells, it would appear:

That the Germans are not particular in having shell steel of uniform quality.

That the steel used is generally of relatively high tenacity, and much more liable to break up by shock than what we produce and prescribe.

That most probably some of the German shells are made by the basic-Bessemer process, judging from the relatively large amount of nitrogen present in one of the toughest and best fragments, which also contained 0.07 per cent sulphur and phosphorus.

That the analyses of the armor-piercing shells correspond with analyses of similar material made in other countries.

That if the high-explosive shells with between 0.07 and 0.1 per cent phosphorus did not burst in the gun, it seems probable that great freedom from that element has been found to be unnecessary.

In view of these considerations, is there not reason for our authorities to doubt the expert advice given them—on which, of course, they must depend—to restrict so drastically the allowable quantity of both sulphur and phosphorus, thereby restricting the output of shell steel? As the question can so readily be settled by making suitable mechanical tests on the finished shells such as I myself have made with convincing result on material at present barred, is it not in the national interest that such tests should be made without delay by the authorities at headquarters?

If the results of my mechanical tests are confirmed then the obvious thing to do is to alter the specifications forthwith. If the mechanical tests are found to be conclusive, then it would be a national crime to reject material on any chemical specification before submitting the steel in question in the form of a finished shell to the more convincing mechanical test.

LATER SHELLS SHOW LOWER MANGANESE

Commenting editorially on Dr. Stead's paper, the London *Iron and Coal Trades Review* said: "It would have been most interesting if Dr. Stead had been able to throw more light on the analyses of German shell steels. Analyses, for instance, of German shells from the beginning of the war up to the present time should give a good deal of information as to the manganese position in Germany. Presumably all the naval shells, the analyses of which are tabulated by Dr. Stead, were made before the war, when manganese was plentiful. The consumption of German naval shells must, indeed, have been small, and no doubt the stock was no less adequately looked after than the stock of other war material. The German naval shells all run high in manganese but if the analyses of the shells from Flanders, Ypres and Dunkirk are examined—presumably artillery shells—it appears that, while the Flanders shells contain as much as 0.74 to 0.98 per cent of manganese, the Dunkirk shell analysis only shows 0.38 per cent manganese—a low percentage. Probably this Dunkirk shell was of comparatively recent manufacture, and seems to indicate a marked economy in manganese, more especially as the average manganese content of the other shells is nearer 1 per cent than 0.38 per cent. * * * *

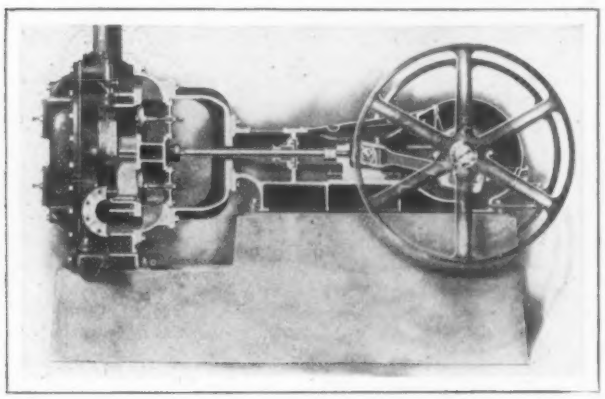
"Dr. Stead suggests wider limits in specifications. We can still go a good way and yet not reach the German phosphorus figures. It is now a year ago, when the shortage of shells first became acute, that we made the same suggestion in these columns—an essential step, indeed, if the German output was to be approached in quantity in this country. The phosphorus limit was at that time 0.04 per cent. It has since been increased, and if the French War Office will accept 0.08 per cent phosphorus there should be very good reasons advanced for requiring a lower limit in this country.

"Dr. Stead, on chemical grounds, arrives at the conclusion that the Germans are using basic Bessemer shell steel. In view of the fact that more than one-half of the German steel-making capacity is of this character, we should say that there has never been very much doubt about it. If their output of shell steel is anything like the figures recently estimated they must have used a very large tonnage of basic Bessemer steel."

The Republic Iron & Steel Company, Youngstown, Ohio, has ordered a Brassert-Bacon gas washer for the new blast furnace it is erecting.

New Pump for High-Vacuum Service

A new horizontal center crank type dry vacuum pump has been brought out by the Ingersoll-Rand Company, 11 Broadway, New York City. It is intended for condenser and other services where it is necessary to



A Pump for Condenser and Other Services Requiring the Maintenance of a High Vacuum Equipped with an Automatic Lubricating System

maintain a high vacuum, and has been developed from the company's straight-line air compressor. The pumps are intended for either steam or belt drive and are provided with an automatic lubricating system in place of the customary arrangement of grease cups. The capacity range is from 292 to 2295 cu. ft. per minute, and it is pointed out that the capacity of a pump of a given size has been increased to such an extent as compared with an equal capacity machine of the old type that a reduction of approximately 66 per cent in the amount of floor space required has been effected. It is claimed that the pumps are capable of handling discharge pressures of several pounds and will maintain a vacuum of within ½ in. of barometer against a closed intake.

The builder's Ingersoll-Rogler valves of the multiport plate type are used on the vacuum cylinders. They are automatic in action and designed to give a large port opening with only a slight lift and to require no lubrication. The inlet valves are located in the top of the cylinder heads and the discharge valves in the bottom, the construction tending to secure the immediate discharge of any liquid entering the cylinder. These valves are capable of operation at high speed which has made possible the increased capacity and reduced floor space mentioned.

The steam-driven type of pump is provided with a balanced piston steam valve that is relied upon to permit the pump to be operated with high pressure superheated steam. This class of pump has a continuous sub-base extending under the entire unit. Both the vacuum and the steam cylinders are lubricated by a force feed arrangement which is automatic in action. A set of movable cast covers is designed to prevent the lubricant from escaping, while at the same time dust and grit are excluded without interfering with quick access to all parts. The belt-driven type of pump is furnished either with an electric motor and short driving belt as a complete unit, or with a plain belt pulley for drive from some other source of power.

The Baldwin Locomotive Works, Philadelphia, is reported to have purchased a tract of over 100 acres of valuable property on the Delaware River in Ridley township and just north of its present extensive holdings at Eddystone, Pa. It is understood that $1,750 per acre was paid. While it is not stated to what use the land is to be put the rumor is revived that the plant at Philadelphia will be removed, as this acquisition gives the company plenty of room.

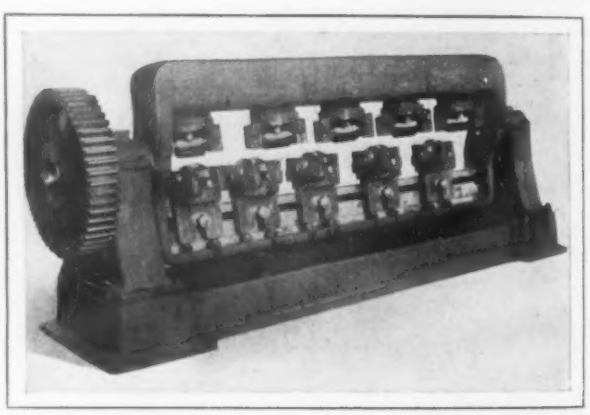
The Price Iron & Steel Company, Peoples Gas Building, Chicago, has purchased the entire plant and equipment at the Harrison Street Station of the Commonwealth Electric Company and will dispose of the machinery as a whole or in part.

A 10-Roll Straightening Machine

A special machine for straightening round bars ranging from 1 to 2½ in. in diameter has been placed on the market by the Brightman Mfg. Company, Columbus, Ohio. This machine, which is designated by the builder as a 10-roll machine, not only straightens the bars but in addition puts a high finish on them in a single pass. This is the specially distinctive feature of the machine which will straighten and finish from 20 to 40 ft. of bars per minute, depending upon the size of the material that is being run through and the speed at which the machine is being operated.

As will be noticed from the accompanying illustration the machine consists of a bed with upright pedestal bearings supporting a revolving frame and the straightening mechanism. This consists of ten rolls supported by bearing blocks provided with both a swivel and a screw adjustment, half of the rolls having concave surfaces and the remainder plane ones. The roll supports are mounted on the revolving frame, which has hollow journals, to project alternately from the opposite sides, the only exception being at the receiving end where the rolls are located directly opposite each other. A gripping device moves over the tracks provided at each end of the machine and is relied upon to prevent the material that is being handled from revolving.

The contact of the rolls in the revolving frame is relied upon to secure the speed variation, this being controlled by the amount of concave surfaces put on the rolls. Each roll has a segmental line of contact with the material being handled, and the rolls are adjusted at an angle according to the size of the stock. This arrange-



A Special 10-Roll Machine for Straightening Round Bars Ranging from 1 to 2½ In. in Diameter and Putting a Polished Finish on Them in One Pass

ment is found to eliminate gouging out or breaking the edges of flaws or cracks which might be present in the surface of the material and can be smoothed over. A certain amount of slipping that is done by the rolls, it is explained, produces the polished finish on the stock.

A new monthly, entitled *Hospital Management*, published by the Crain Publishing Company, Louisville, Ky., has made its appearance. It is announced that a department for industrial hospitals will be a permanent and important feature of the publication, the idea being to record developments in the rapidly growing field of welfare work. The leading article in the issue for February describes the hospital of the Youngstown Sheet & Tube Company, which was recently opened with Dr. Sidney McCurdy in charge.

The Rateau Battu Smoot Company, 140 Cedar Street, New York, has received an order from the Cerro de Pasco Mining Company, Peru, for a steam-turbine-driven blower and alternator and a motor-driven centrifugal blower. The blower of the first-mentioned unit is to have a capacity of 30,000 cu. ft. of air per minute at 30 lb. pressure sea level, and the alternator is to be of 1900 kw. capacity and operated at 3000 r.p.m. The other blower is to deliver 24,000 cu. ft. of air at 3 lb. pressure.

Yearly Records of Quantities Purchased

System to Give Purchasing Department Data Upon Which Probable Future Monthly and Annual Requirements Can Be Based

BY H. A. RUSSELL*

The records of the purchasing department are not complete unless some means have been provided for making a permanent record of the quantities purchased during the year. Furthermore the record should be arranged so that a quick comparison can be made, of the quantity of any one article or line purchased year by year. This record is particularly valuable in factories where the manufactured lines do not vary greatly from one year to another. The information is indeed essential when making contracts covering future deliveries, for periods covering several months or even a year. If the record is intelligently planned and maintained it will often be a means of preventing the ordering of excessive amounts.

In the plant, with which the writer is connected, it has been necessary to have three separate stockrooms, owing to the ground area covered. There are certain items which are duplicated in these stocks and in the event that one of the items would no longer be required, as far as any one of the stockrooms is concerned, the remainder of the item on hand can be transferred to one of the other stockrooms and be used up in the manufacture of some other machine than that for which it was originally purchased. Should a surplus of this kind occur, the matter is at once reported to the purchasing department, which from its records, can reach a quick decision as to whether to transfer the item or items to one of the other stockrooms or dispose of the surplus elsewhere. By keeping in close touch with these situations and being in a position to act promptly when they arise will mean that the stocks on hand are being kept closer to actual requirements and that the "dead" items are reduced to the minimum.

Each factory or mill will have different items to record and what is an important item in one plant is of practically no consequence in another. Therefore the information on the forms illustrated may not appeal to all readers but the idea can very readily be applied to individual needs and such variations made as will seem necessary and give the desired results. A total yearly quantity may not be as important as the quantity used during the rush season. There will be some items of which 75 per cent of the yearly quantity will be used during a few months and the remaining 25 per cent will be scattered over the rest of the twelve months. It is quite possible to indicate the proportion used during the rush season and to have a comparison of these rush-season quantities, separate and distinct from the record of the quantity used during the remainder of the year. In other words a little careful planning will always provide the stepping stone to clear and concise records but careful planning minus intelligent execution will not be very likely to give satisfactory results. Therefore each system as it is put in operation should be carefully explained to the clerk who is to have charge of it. Generally a brief outline of what the final results should be will help the party having the system in charge.

QUANTITY RECORD PURCHASE DEPT.
Malleable Chain + Attachments 1915

SIZE OR PAT. NO												TOTAL
#25 Chain	1000'	1000'	2000'	2000'								6000'
#33 Chain	2000'	1000'	700'	200'	1000'	500'						5320'
#35 Chain	2000'	2000'	2000'	2000'	4000'	2000'	1000'					15000'
#45 Chain	4000'	3000'	3000'	4000'	5000'	5000'	2000'	2000'	4000'	2000'		41000'
	5000'	2000'										
#55 Chain	4000'	4000'	3000'	5000'	5000'							23000'
K1-88 #45 Chain	200 lbs	100 lbs	500 lbs	100 lbs								1200 lbs
A1-88 #45 Chain	500 lbs	400 lbs	500 lbs	Do 1000	Do 500							2900 lbs
#77 Chain	1000'	500'	900'	300'								2500'
#103 Chain	100'	100'	100'									300'

Form Upon Which Quantities of Material Bought Are Entered as Purchases Are Made

Before going any further it might be well to state that all names and figures used are fictitious. They will, however, answer the purpose just as well as the original records, inasmuch as the forms shown are actual copies of those in force in this department.

The reproduction of the card entitled "Quantity Record-Purchase Dept." shows the record that is kept of the receipts of malleable chain, or link belt. The chain is entered by the number of feet and the attachments either by feet or links. It has not been considered necessary to record the name of the seller, or the date of the invoice. The latter is not essential and the seller's name and the discount are recorded elsewhere. At the end of the year, after all the totals have been transferred to the permanent record card, all of these "Quantity Record" cards are destroyed. Before they are destroyed, however, a complete set of cards is prepared for the year ahead.

Two different styles of cards are used to accumulate the yearly quantities for the reason that this method gives the best results. Certain purchased items need only be recorded by quantity, while others require more complete information. The particular card shown indicates the amount of bituminous coal received through the year, and, fur-

*Author of "Records for the Purchasing Department," THE IRON AGE, Aug. 5, 1915, and "Anticipating Buying Emergencies," THE IRON AGE, Dec. 2, 1915.

Coal - Bituminous - 1915 — See also Card No. 2 — Power House — Card No. 1

Date	Shipper	Brand	Weight	Rate	Freight	Date	Shipper	Brand	Weight	Rate	Frt.
1/3/15	Blank Coal Co.	Highstep	104100#	9.25	9.50	4/20	Boston Coal Co.	Fairmont X	104300#	9.25	9.60
1/10	" " "	" "	107100#	"	"	4/27	" " "	" "	102700#	"	"
1/17	" " "	" "	98400#	"	"	7/3	" " "	" "	103400#	"	"
1/24	Boston " " Good	Fairmont X	76000#	9.35	9.60	7/10	" " "	" "	104400#	"	"
2/2/15	Blank " "	Highstep	101700#	9.25	9.50	7/18	" " "	" "	61000#	"	"
2/9	" " "	"	104400#	"	9.60	7/25	" " "	" "	62070#	"	"
2/16	" " "	"	107600#	"	"	7/29	" " "	" "	103900#	"	"
2/23	" " "	"	109500#	"	"	8/4	Apex Coal M. Co.	Apex B	107900#	9.20	9.50
3/1	" " "	"	64800#	"	"	8/11	" " "	" "	106400#	"	"
3/8	" " "	"	103800#	"	"	8/18	" " "	" "	107400#	"	"
3/15	" " "	"	104500#	"	"	8/24	" " "	" "	106600#	"	"
3/22	" " "	"	107400#	"	"	8/31	" " "	" "	81000#	"	"
3/29	" " "	"	106500#	"	"	9/10	" " "	" "	106400#	"	"
4/5	Boston " "	Fairmont X	109600#	"	"	9/14	" " "	" "	109800#	"	"
4/12	" " "	" "	104700#	"	"	9/21	Blank Coal Co.	Highstep	107000#	9.25	"
4/19	" " "	" "	99800#	"	"	9/27	" " "	" "	102400#	"	"
4/26	" " "	" "	100000#	"	"	10/4	" " "	"	104700#	"	"
5/2	" " "	" "	101400#	"	"	10/11	" " "	" "	104900#	"	"
5/9	" " "	" "	97600#	"	"	10/18	" " "	" "	108700#	"	"
5/16	" " "	" "	104600#	"	"	10/25	" " "	" "	86400#	"	"
5/23	" " "	" "	105000#	"	"	11/2	" " "	" "	63000#	"	"
5/30	" " "	" "	107400#	"	"	11/9	" " "	" "	107000#	"	"
6/6	" " "	" "	106500#	"	"	11/16	" " "	" "	109000#	"	"

The Coal Record Card for the Power House Giving Dates of Purchases, Names of Shippers and Brands, Weight of Purchases and Cost of Coal and Freight

ther, the name of the seller, the brand of the coal, the price at the mine, the freight rate and the results obtained when the boilers were fired with each brand. In the absence of any particular notation, it is understood that the brand was satisfactory. The fourth entry on this card contains the notation "Good." This was the first car of this brand that was used here and the entry was made as a guide for the future. Had reverse results been obtained, the notation would have been "N. G." All this information is of value to the buyer, especially the latter notation, as it provides a check against his being hoodwinked the second time on the same grade or brand.

The method of transferring the accumulated information from the "Quantity Record" cards is apparent from one of the other illustrations. It provides an instantaneous comparison of the quantities received of each item, year by year, and a further comparison of the total yearly quantities. A separate column is provided for a ten-year average. This card contains only the record of the number of feet of each size of chain. Similar cards are used for the attachments. In all instances where more than a single card is needed to complete the record the cards are numbered consecutively, starting with 1. This does away with any chance of a card being overlooked, as a notation is made at the top of each card, calling attention to the remaining cards making up the complete set. The accumulative record cards are of standard size, 5 x 8 in., but the yearly record cards are of a special size, 5 in. high by 14 in. long. It was necessary to order a special size drawer for these longer cards but the cost was small.

The buyer usually likes to know how much the

Chain - Malleable. Also Attachments. All Departments. See Cards #2 & #3 for attachments.

No. Size	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	Ten Year Average	1915
#25 Chain	4000'	3000'	5000'	6200'	5000'	4700'	4000'	3600'	5200'	4100'	44300ft.	6000'
#32 Chain	6200'	7000'	9100'	7100'	4800'	5400'	6000'	5000'	5000'	5200'	61400ft.	5500'
#35 Chain	14500'	12500'	9000'	12500'	17000'	14000'	14400'	16700'	12500'	14600'	137500ft.	15000'
#45 Chain	28800'	30400'	31000'	38400'	30000'	26000'	33700'	36000'	35000'	44900'	333600ft.	43000'
#55 Chain	11000'	14000'	19000'	12500'	14700'	28000'	20200'	31000'	27000'	21900'	199300ft.	23000'
#57 Chain	600'	400'	1100'	1000'	900'	200'						
#67 Chain						700'		800'	600'			
#77 Chain	1200'	1100	1400'	200'	400'			700'	1200'	1900'		2500'
#103 Chain	100'	200'	400'	400'	600'	900'	700'	400'	300'	500'	4500ft.	300'
Yearly Total	65600ft.	68100ft.	76000ft.	78400ft.	73400ft.	79900ft.	79000ft.	94200ft.	90100ft.	93700ft.		

A Yearly Purchase Card Compiled from the Quantity Purchase Records

monthly purchases amount to, as a total and for certain individual items. Another 5 x 8-in. card is used for the purpose of comparing monthly purchases of certain lines. This record serves as a check against excessive buying and may be expanded to take in all the purchased lines as exhaustively as may be deemed necessary. These cards are filed away for future reference, or if required the data can be incorporated in such a manner as to provide a comparison of the purchases of each item in the corresponding months of each year. By so doing the purchasing department will have a fairly reliable guide for the approaching month, as to the probable expenditure.

A binder sheet, which has been pen ruled so as to provide a yearly comparison of the total value of the various items, is also used. Two five-year averages are provided, also an average for a ten-year period. A similar record is kept of the tonnage amounts used. This provides considerable assistance in making contracts for such items as bar steel, boiler plate, tubes, rivets, etc.

With these records complete and up to date, the buyer has a means of regulating his purchases, which would be, without these records or some other effective plan, a more or less guesswork matter. Should the purchase value of any certain item become excessive the buyer automatically receives a warning from the comparative yearly or monthly records.

Monthly Purchase Totals - 1915

Article	Jan.	Feb.	Mch.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Engine Fittings	$90	$90	$50	$40	$10	$60	$55	$10	$80	$90	$65	$105
Malleable Cast.	$70	$20	$41	$30	$07	$00	$00	$01	$07	$10	$07	$30
Steel Castings	$31	$100	$35	$20	$16	$31			$86	$36	$00	$41
Boiler Plate	$600	$500	$400	$600	$450	$900	$700	$100	$2200	$800	$100	$146
Boiler Tubes	$50	$450	$60	$650	$00	$60	$600	$60	$100	$400	$200	$10
Boiler Rivets	$41		$30			$15			$56			$14
Leather Belt	$20	$21	$10	$00	$10	$15	$02	$41	$17	$20	$06	$26
Rubber Belt	$0	$24	$1	$11	$19	$17	$30	$30	$15	$07	$35	$06
Lumber	$400	$450	$100	$400	$600	$200	$210	$900	$600	$170	$200	$900
Steel Bars	$150	$70	$90	$60	$170	$100	$70	$00	$70	$10	$00	$80
Pig Iron	$70	$00	$00			$30	$70		$10	$70	$00	$40

Form Employed to Show the Amounts Paid Each Month for Various Articles

The Norwegian Tin-Plate Mill

A Norwegian-American engineer has expressed his willingness to undertake the construction and management of a new tin-plate works along American lines in Stavanger, Norway, the contemplated establishment of which was mentioned in THE IRON AGE, Feb. 24, 1916. This engineer stipulates, as a condition of his acceptance, that the plant shall have a yearly capacity of 30,000 metric tons, which amount is used in Stavanger alone, but is now imported. Both English and American systems are said to have been considered, with the latter regarded as productive of better results, since in England special emphasis seems to be placed on personal and manual skill while in the United States the machine process is highly developed.

It is expected that the engineer will take men from the United States familiar with the machinery in order to install the American system as promptly as possible. Many American citizens of Scandinavian origin are familiar with this industry and willing to return for work on such a project. A similar enterprise is being undertaken in Bergen, Norway, about 150 miles north of Stavanger.

The United States Civil Service Commission announces two competitive examinations which are of interest to men connected with the steel trade. One is for a master steel maker, salary $8 per diem, to fill a vacancy in the navy yard at New York, for which applications for examination must be filed with the commission at Washington prior to the closing of business March 21, and the other is for a physical metallurgist, salary $4 to $6 per diem, to fill a vacancy in the navy yard, Boston, for which the examination will be held March 22 at the usual places.

Joseph T. Ryerson & Son will shortly begin work on a large addition to the warehouse facilities of their Hagar branch in St. Louis, Mo.

For Waterpower Development

The Waterpower Development Association is the name of a new organization which has opened offices at Washington, D. C., and will launch a campaign of publicity designed to aid the Administration in securing the passage of laws to encourage the development of waterpowers in the public domain and the navigable streams. It is composed of manufacturers of water wheels, hydraulic and electrical machinery and supplies, who look forward to a revival of the waterpower industry when the general dam act and the leasing bill for the power sites in the public domain, supported by President Wilson and by Cabinet officers, are enacted into law. Marcus A. Beeman, secretary of the association, says:

"The purpose of the association is to tell the truth about waterpowers and the waterpower business. We intend to tell the American people the facts that have been kept from them as to why our waterpowers are allowed to flow to waste, while we burn coal at high prices to generate power. We propose to expose the crime that has been committed in locking these natural resources from use and keeping them locked from use, and the benefits that will accrue to the whole nation from development and use, as well as to make plain what kind of legislation is necessary to induce investment in waterpower development.

"The affairs of the association are in the hands of a committee made up of Harry W. Hand, vice-president of the I. P. Morris Company, Philadelphia; W. W. Nichols, Allis-Chalmers Mfg. Company, Milwaukee; Chester W. Larner, Wellman-Seaver-Morgan Company, Cleveland; J. E. Way, R. Thomas & Sons Company, East Liverpool, Ohio, and Calvert W. Townley, Westinghouse Electric & Mfg. Company, East Pittsburgh. Marcus A. Beeman, secretary of the association, has been assistant secretary of the Cleveland and of the Buffalo chambers of commerce, and secretary of the New Jersey State Chamber of Commerce."

Electric Shell Steel in Canada

The Canadian Brakeshoe Company, Sherbrooke, Quebec, is operating four 2½-ton basic-lined 3-phase electric furnaces making 4.5-in. shell blanks for the British Government. The company states that it has been doing this for the past eight months and that previous to that it had been making general castings for two years. The furnaces run continuously and turn out four heats each every 24 hr.

A course in chemical engineering with special reference to graduate fellowships in gas engineering, metallurgy, etc., is announced by a bulletin issued by the University of Michigan, Ann Arbor, Mich. Several companies, among them the Detroit Edison Company, have established fellowships of $600 to $1,000 for special investigation in certain lines.

Semi-Steel Defended and Attacked

What It Is and How It Should Be Made, as Well as Its Value to the Foundryman, Told by

Y. A. DYER

WITHIN the past two or three years there has probably been no question more frequently asked in foundry circles than: "What is semi-steel?" One foundryman says: "I do not believe that steel will mix homogeneously with cast iron." Another says: "The reverberatory furnace is the only medium for the mixing of steel and cast iron"; and still another says: "Even a steel or iron rod thrown in a cupola with cast iron will produce hard spots and shot in the casting."

Yet the up-to-date foundryman is daily using from 10 per cent to 30 and 40 per cent of steel scrap in his cupola mixtures and turning out close-grained, tough, clean and easily machined castings capable of registering tensile strengths of 32,000 to 38,000 lb. per square inch and transverse strengths of 3500 to 4000 lb. per square inch compared with 1800 to 2400 lb. in the case of ordinary gray-iron castings. This is certainly an improvement that has never yet been achieved, having in mind machinability, by a mixture of different grades of pig iron, or of pig iron and cast scrap. Therefore, while this improved quality metal may be properly classed, strictly speaking, as gray iron, it so far excels, in strength and texture, the gray iron of the past and present that it is entitled to a name that will place it in an intermediate position between gray iron and malleable iron, just as malleable iron deserves its name to designate a metal that is intermediate between cast iron and steel, and the writer knows of no more appropriate commercial name than "semi-steel." After all, steel and malleable are only refined pig iron—semi-steel is only refined cast iron.

I know of no other cupola mixture that has been put to better use, and, likewise, no other mixture that has been more abused, all on account of carelessness. There are foundrymen in all sections of the country who have tried it with disastrous results, and, naturally, they have bitterly denounced the practice. However, as has been true in many other lines of business, the "day of reckoning has come," and the gray-iron foundryman realized that he has stood idly by and seen his legitimate business pass into the hands of the steel and malleable iron founders. In many cases this has come about because he refused to make a persistent and searching effort to see to the improvement in quality of his work. He has rather been satisfied with the thought: "My father did business in this way; it is good enough for me."

The temptation to "slip in" high percentages of low-grade scrap (in order to underbid the other fellow a few cents on a job) still proves irresistible, and where this practice is continued to-day one can generally point to a foundryman who finds his work confined to grate bars, sash weights and a few rough municipal castings. This applies to one class of foundrymen—the one who is willing to go along without learning. There is another class that is willing to learn. Injudicious mixing of the best materials will not produce a high-grade casting.

Since the steel casting has come into such general use, the foundryman has taken notice and is endeavoring to improve his work, a condition, unfortunately, he allowed to be forced upon him. The result has been many experiments with different grades of pig iron and scrap, with varying results. One test would show a strong, firm casting, perfect in proportions, but hard to machine; another casting would come from the mold in excellent shape—soft, easily machined, yet lacking in strength. A happy medium was indeed a hard problem. The question was how to close up the grain of the iron, yet leave the casting tough, clean and easily machined. The grain could be closed by the use of very low silicon iron, but physically the casting would be hard and brittle. With high silicon iron a clean, easily machined casting could be produced, but it was lacking in strength.

In order to get away from the ills of pig iron neutralizing elements must be balanced. Carbon, being the controlling element, must be brought to the desired point; phosphorus, tending to brittleness, must be lowered; manganese, acting as a desulphurizer and gas absorber, must be kept sufficiently high, and silicon, which produces weakness, must be kept to its lowest practicable limit. Soft steel is very low in carbon, exceedingly low in silicon (sometimes only a trace), low in sulphur, low in phosphorus, and reasonably high in manganese. Therefore, why should this metal not be an ideal one to supply the deficiencies in a mixture of ordinary pig iron of different grades or pig iron and scrap?

As to the question whether or not steel will mix homogeneously with pig iron and cast scrap, one has only to bear in mind that pig iron is the mother of both cast iron and steel. If there should be any doubt as to its mixing uniformly and satisfactorily, it is merely necessary to try it in the cupola under the proper conditions with any percentage desired. What is meant by proper conditions will be explained further on. By the proper mixing of from 10 to 40 per cent (even 50 and 60 per cent) of steel (low carbon preferable) in the ordinary cupola along with all pig iron of suitable analysis, or pig iron and selected cast scrap, a sound, tough, close-grained and easily machined casting of high tensile and transverse strength can be produced—especially suitable for cylinders of all kinds (including automobile cylinders), gears, pinions, piston rings, liners, carwheels, plow points, rams, grinders, crushers or any high-duty casting.

REQUIREMENTS WHICH MATERIALS MUST MEET

In the manufacture of semi-steel, the pig iron to be used as a base metal should be under 0.60 per cent in phosphorus and over 1 per cent in manganese. The silicon in the pig, for work requiring close grain and high strength, should be from 2.25 to 2.45 per cent; for small and comparatively thin castings the silicon in the pig should run from 2.50 to 2.80 per cent. Of course, the lower the sulphur the better. If low-grade pig iron should be used with above base metal, No. 3 or No. 4 foundry iron will suit. If scrap should be used, No. 1 machinery is best. Low-carbon steel is preferable in the mixture, such as croppings from angle bars and structural material, concrete bars, cast steel (agricultural and machinery), shafting, pipe, rails and boiler plate, all of which will range approximately

as follows in analysis: Silicon, 0.03 to 0.35 per cent; sulphur, 0.05 per cent or under; phosphorus, 0.01 to 0.10 per cent; manganese, 0.40 to 0.80 per cent. As the manganese has a broad bearing on semi-steel, it is well that this element should be watched closely in the mixture, and range from 0.40 to 0.75 per cent in the casting. For plow points, crusher and grinder castings, it should run from 1 to 1.25 per cent in the casting. Manganese in the pig iron and other material used will more uniformly mix in the bath than if it should have to be supplied in the form of ferromanganese. If ferromanganese should have to be used, lump form, charged in the cupola, will give better results.

In all my tests in the making of semi-steel, I soon learned that assembling suitable raw material is only about 25 per cent of the successful operation. Proper charging of the material and correct cupola practice must be followed. My investigations started at the blower and ended at the cupola door. Blower revolutions were adjusted to deliver between 27,000 and 30,000 cu. ft. of air per ton of metal; tuyeres in the cupola were adjusted to 18 to 20 per cent of the area of the cupola to admit air by volume rather than by pressure, and thereby eliminating excessive oxidation of metal. The melting zone of the cupola was ascertained and the coke bed measured to have a well-burned bed on the line of the zone when charging was started (another method which prevents oxidation); and, last but very important, even weight charges of metal went into the cupola, and 1 to 10 coke charges between each metal charge. These methods insured proper combustion, proper and uniform melting and a stable melting zone at all times.

TESTS OF HORIZONTAL 1-IN. SQUARE BARS

Test bars from the mixtures given below were 1 x 1 x 16 in., cast in green sand horizontally and were unmachined. One-inch square bars were used from the fact that the writer has never seen a record of semi-steel test bar of larger or present standard size. However, the last three mentioned mixtures were bars 1¼ x 1¼ x 16 in., cast vertically in green sand and unmachined. The deflection ranged from 0.10 to 0.20 in., and the total carbon from 2.85 to 3.50 per cent.

Following mixture was used for cylinders, showing 37,000 lb. tensile strength and 3700 lb. transverse strength:

Make-up of Mixture and Analyses for Cylinder Castings

	Charge, Per Cent	Si.	S.	P.	Mn.
Clifton pig iron....	25	2.35	0.02	0.53	1.25
Steel scrap.....	25	0.05	0.05	0.05	0.40
No. 1 machinery..	50	2.00	0.08	0.80	0.50
80 per cent ferro-manganese	0.01	...	...	...	...
Casting analysis...	...	1.45	0.09	0.55	1.02

Following mixture was used for acid-resisting casting, showing 38,000 lb. tensile strength and 4050 lb. transverse strength:

Make-up of Mixture and Analyses for Acid Resisting Castings

	Charge, Per Cent	Si.	S.	P.	Mn.
Clifton pig	50	2.25	0.02	0.55	1.25
Sloss pig	25	2.50	0.03	0.70	0.75
Steel rail	25	0.10	0.05	0.05	0.40
Casting analysis...	...	1.75	0.05	0.45	1.00

Following mixture was used for general run of foundry castings, showing 36,000 lb. tensile strength and 3625 lb. transverse strength:

Make-up of Mixture and Analyses for General Foundry Castings

	Charge, Per Cent	Si.	S.	P.	Mn.
Clifton pig	30	3.35	0.03	0.51	1.20
Cast scrap	30	2.25	0.08	0.70	0.35
Steel	40	0.10	0.05	0.05	0.40
Casting analysis ...	...	1.65	0.07	0.45	0.47

Following mixture was used for 3 to 12 in. target shells, showing 35,000 lb. tensile strength:

Make-up of Mixture and Analysis for Target Shells

	Charge, Per Cent	Si.	S.	P.	Mn.
Clifton pig	25	3.25	0.03	0.53	1.10
Select scrap	50	1.80	0.06	0.55	0.40
Boiler plate	25	0.05	0.04	0.05	0.40
80 per cent ferro-manganese	0.005	...	...	...	...
Casting analysis...	...	1.52	0.06	0.41	0.55

TESTS OF VERTICALLY CAST 1¼-IN. SQUARE BARS

The tests of bars 1¼ x 1¼ x 16 in. in size and the mixtures used for ordinary run of jobbing foundry work (from gear wheels and pinions to manholes) were as follows:

With 40 per cent Clifton iron, 40 per cent machinery scrap and 20 per cent steel, the metal showed silicon, 1.67 per cent; sulphur, 0.08 per cent; phosphorus, 0.52 per cent, and manganese, 0.50 per cent; test bar broke at 7490 lb. per sq. in.

With 30 per cent Clifton iron, 60 per cent machinery scrap and 10 per cent steel, the metal showed silicon 1.82 per cent; sulphur, 0.05 per cent; phosphorus, 0.45 per cent, and manganese 0.59 per cent; test bar broke at 5480 lb. per sq. in.

With 40 per cent Clifton iron, 50 per cent machinery scrap and 10 per cent steel, the metal showed silicon, 1.83 per cent; sulphur, 0.05 per cent; phosphorus, 0.46 per cent, and manganese, 0.64 per cent; test bar broke at 5690 lb. per sq. in.

Above tests were made in Southern and Southwestern foundries where there was a good tonnage of excellent machinery scrap available, so that that metal was used in preference to low-grade pig iron. All classes of work were tested, and in every instance there was an improvement shown of 40 to 50 per cent over the old ordinary gray-iron casting, both as to physical test and machinability. Under these circumstances, I do not think that fair-minded foundrymen will object to this metal occupying a distinctive class; neither do I think that a more appropriate name could be applied than semi-steel.

Why the Term Semi-Steel Should Not Be Accepted Is Argued, at Suggestion of The Iron Age, by

DR. RICHARD MOLDENKE

I was very much interested in reading Mr. Dyer's paper, and beg to add a few comments. Mr. Dyer holds that the product of the cupola obtained by melting steel with the ordinary pig and gray-iron charges, and giving metal with a tensile strength up to 38,000 lb. per square inch, is so far ahead of ordinary gray iron that it merits a special name. Further, in his opinion, the designation semi-steel is an appropriate commercial one, as good as any. I question this. A matter of commercial ethics is involved. The material thus designated has none of the properties of steel that make it distinctive as such, and even on the question of strength, who shall say where the dividing lines between low-grade, ordinary and high-grade cast irons shall be drawn? Every foundryman claims to make high-grade castings whether he uses much or little steel, or none, and the ignorant customer is made to believe and pay accordingly.

When the trade name semi-steel was first ap-

plied by Joseph Seaman of Pittsburgh to gun iron from his air furnaces in which up to 30 per cent steel scrap had been added, it was at a time when the metallurgy of cast iron was unknown, and for that matter but little of steel metallurgy was understood.

HOW TERM SEMI-STEEL ORIGINATED

The name was therefore a perfectly honest designation of what certainly was a marked advance in gray-iron practice. Mr. Seaman was entitled to all the commercial benefits to be derived from his patient experimentation. To-day, however, with our extended knowledge of the properties of materials and their metallurgical characteristics, the establishment of a separate division for those products between the border line of cast iron and steel opens up opportunities for shrewd salesmanship which should determine the buying public as well as foundrymen's associations and interested technical bodies to demand the elimination of the term semi-steel *in toto*.

A perusal of Mr. Dyer's paper is interesting, and would seem to call for special comment in but two particulars. First, that cast iron with the silicons given, namely, 1.45 to 1.65 per cent, will often show tensile strengths in 1-in. square bars of 33,000 to 37,000 lb. per square inch without the addition of any steel to the mixtures. Where, then, are his results so far ahead of ordinary gray iron as to merit a special designation? In fact, the total carbon determinations quoted (2.85 to 3.50 per cent) would indicate that the steel added was nearly lost in the shuffle.

The second point for comment is the statement that after assembling suitable raw materials, he began his investigations "at the blower and ended at the cupola door," meaning, presumably (from the further context), at the cupola spout, as he gave special attention to charging and melting conditions. In the estimation of the writer, Mr. Dyer stopped half way in his investigations. The writer has before him one broken casting of a lot of defective duplicates made from the same heat containing 25 per cent steel scrap in the mixture. The other castings (from different patterns) of this heat had turned out excellently. The characteristics of the defective work are: First, a serious collection of shrink holes and spongy metal at the junction points of different brackets. Second, a very marked difference in structure from center to edge of a clean fracture through apparently sound metal. This is a case of pouring metal with little "life" into molds not gated to suit such a situation.

A QUICK-SETTING METAL REQUIRING CARE IN MOLDING

Melting large percentages of steel scrap with gray iron means a quick-setting metal, particularly if only just the right amount of fuel has been used. Usually this is complicated by undue oxidation of the steel before it melts and a none too high temperature of the metal from the spout. The result is that molds as ordinarily gated will not allow a proper feeding of the casting, and wherever the thinner sections about a heavy point may have set, the liquid portions, unable to draw in fresh metal, will result in iron with heavy "draws," and even the sound portion will show very open interior structures. Yet such castings would be sold as "semi-steel" under the mixture circumstances.

The lower the total carbon and greater the oxidation of the metal gotten when steel scrap is used, the greater the final contraction of the castings and chances for interior shrinkages. Only some adaptation of the "top pour," permitting the descent of the molten metal in small streams straight to the bottom, allowing the metal to remain quiet as the mold fills and draw from above to set sound, will give good results. Gates cut off very quickly and pumping aids but little with such metal, but the customer does not know this. Hence the use of "chills," and care in designing to avoid changes of section as much as possible.

How many foundrymen realize the importance of all this? Unless machining is resorted to gas and shrinkage troubles are not readily detected. The test bar will show up wonderful results, and yet the castings may be quite below par, for test bars are only good to show up the quality of the iron used, not the skill of the foundryman in producing sound work. The casting itself must be broken (or a given percentage of each lot made) to prove up the latter.

The fact that the foundry losses of castings are always heavier when steel scrap is added to the mixture shows in itself that greater chances are taken by the customer in purchasing what he thinks to be superior metal. For this reason only is the foundryman entitled to a higher price when he does produce good work, as the mixture itself costs him less when using steel than if he has replaced it by pig iron.

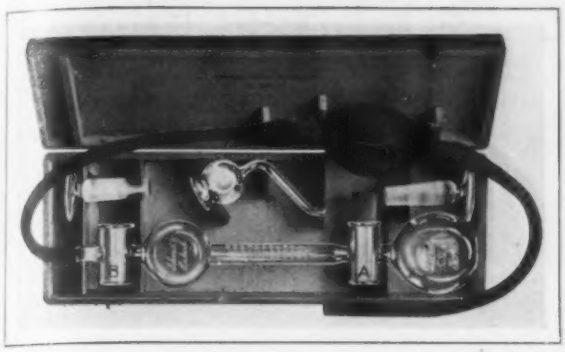
The writer has oftentimes run cupola heats of 100 per cent steel scrap. To get serviceable results an excess of fuel had to be used. The product was cast iron just the same, and nothing "steely" could be traced in the castings made. He may add that in his wide foundry experience and direct contact with the foundry industry, the term semi-steel, originally used in the absence of metallurgical knowledge, would have been decently buried and long forgotten were it not for the systematic exploitation of the name. Every time a specially lurid advertisement is issued, the mail of the writer is burdened with requests for an opinion on the value of the semi-steel, and but for this propaganda, one would not think of making a specific class of one end of the range of gray-iron castings any more than for malleable or steel castings, in which industries it is well known that there are good, better and best results to be obtained also.

What the buyer of supposedly high-grade gray-iron castings may not know is that badly made castings from steel scrap mixtures, erroneously called semi-steel, may be poorer and weaker than the common gray-iron product, and hence the sooner the term semi-steel ceases to exist the quicker will foundrymen and consumers of castings stop fooling themselves and each other.

Pocket-Size Carbon Dioxide Indicator

As a substitute for the standard type of indicator used for determining the amount of carbon dioxide in furnace and flue gases, the Bacharach Industrial Instrument Company, 14 Wood Street, Pittsburgh, Pa., has placed a pocket instrument on the market. This new indicator by reason of its size can be conveniently carried around from place to place and is simple and quick in operation. It employs caustic potash to determine the percentage of carbon dioxide in the gas being sampled.

The bulb at the right, which is the lower one, when the indicator is in use, is filled with a solution of caustic potash, one filling containing enough solution for 200 determinations. To make a determination the rubber tube is inserted in the wall of the flue containing the gas, the valve at *B* opened and a sample of gas pumped in by alternately compressing and expanding the rubber bulb connected with the tube. As soon as a sufficient amount of gas has been drawn out, the valve *B* is closed and the lower one *A* opened to permit the



A Pocket Instrument for Determining the Amount of Carbon Dioxide in Flue and Furnace Gases

gas and the solution of caustic potash to come in contact. After the gas and solution have become mixed the valve is closed and the apparatus inverted and immersed in water. The valve at the other end *B* is now opened, and water flows in to take the place of the carbon dioxide which was present in the flue gas and was absorbed by the potash. The valve is then closed and the apparatus placed in the normal upright position, the height of the water in the graduated tube between the two bulbs indicating the percentage of carbon dioxide. Opening the valve *B* and pouring off the water through it completes the cycle of operations which has taken approximately 2½ min., and the apparatus is now ready for another determination. In connection with rapidity of making the determinations it is emphasized that an inexperienced man can operate the indicator, thus reducing materially the cost of making the determinations.

Operation of Electrolytic Generators

At the plant of the Raritan Copper Works, Perth Amboy, N. J., of which George L. Fales is chief engineer, four-cylinder, triple-expansion, Corliss engines built by the Nordberg Mfg. Company, Milwaukee, Wis., drive 900-kw. generators. The cylinders of these engines are 21, 38, 44 and 44 in. in diameter and the stroke is 48 in. and the generators produce the current employed in the electrolytic refining of copper at the plant. For the last five months of 1915 the units were operated continuously for 96.4 per cent of the total available time. The lowest percentage of operation made by any engine in any month was 77, and a maximum of 99.9 per cent was reached twice by two different engines, the next two months being 99.8 and 99.7 per cent respectively, by still another unit. Practically all the time lost, it is stated, was required for keying up and eliminating lost motion in the valve gears.

At the formal commencement of operations by the Fisher Brass Foundry Company, 228 Muskego Avenue, Milwaukee, Wis., Feb. 25, Louis D. Fisher, general manager, was host to a group of Milwaukee manufacturers and users of brass castings. Mr. Fisher personally poured the first heat, which was used in making a bronze medallion commemorating the opening of the foundry, for presentation to the visitors.

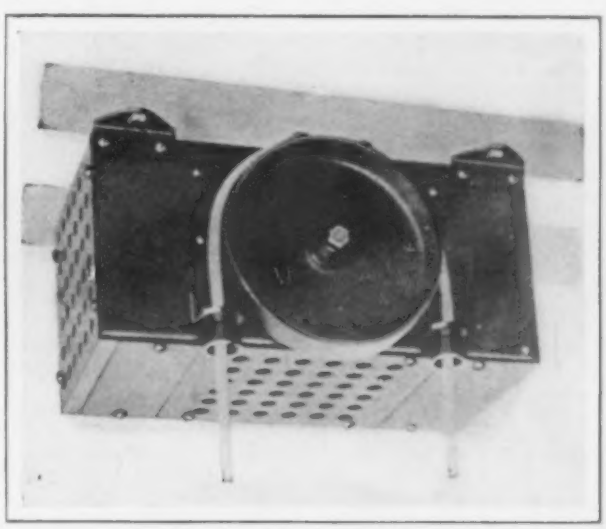
The World's Salesmanship Congress, to be held in Detroit, July 9 to 13, will be the first of a series of annual conventions having for their purpose the placing of salesmanship upon a scientific basis, the training of salesmen and the furthering of proper sales management. A number of the foremost sales authorities in the world will take an active part in the convention. D. M. Barrett, Detroit, is general chairman.

Tin exports from the Federated Malay States in 1915 were 46,767 tons as compared with 49,042 tons in 1914 and 50,127 tons in 1913. The December exports were 4071 tons, the largest in 1915, against 4351 tons in December, 1914.

Intermittent Duty Universal Controller

A line of controllers for use with rope-operated hoists where the service is intermittent in character has been developed by the Allen-Bradley Company, Milwaukee, Wis. The controller is universal in its application in that it can be used with either direct or alternating current motors, and it is emphasized that this is supplemented by a type of construction which enables them to be installed in practically any desired spot. While use with hoists is the primary field for which these controllers were designed, they can also be employed for other intermittent duty and if desired can be operated by a hand lever instead of by a rope passing over a sheave. Other points upon which stress is laid are light and compact construction and the ability to furnish a noticeable amount of speed control when used in connection with squirrel-cage motors.

The resistance units, which are of the builders' standard graphite compression type, and the switch gear are mounted in a single frame, while the entire mechanism, including the terminals and all other current-carrying parts, are inclosed in a steel box which is perforated to dissipate the heat generated in the resistance. Carbon compression resistance is used to do away with the ordinary grid and wire resistances, and in addition to providing a considerable range of speed control renders the device proof against moisture and fumes. The use of a steel cover results in a neat, self-contained device and also affords protection. A drum switch is used for switching the current and ball bearings are employed throughout, thus, it is pointed out, giving long life and easy, smooth operation without the necessity for frequent lubrication.



A Rope Operated Controller for Intermittent Service with Either Direct or Alternating Current Motors

The speed control of squirrel-cage motors secured with this device, while it does not compare with that possible with the slip-ring motor, it is emphasized, is nevertheless enough to be capable of commercial application. The weight of this controller is claimed to be about one-third of that of other makes for the same class of service, and the amount of space required is proportionately smaller.

Prizes for safety suggestions selected as worthy of consideration are awarded the employees of the Youngstown Sheet & Tube Company every month. These were recently announced in one of the series of bulletins which are placed around the works at periodic intervals. An idea of the character of the suggestions may be gained from the subjects of the awards, as follows: Safety suggestion for blast furnaces; ladles for galvanizing kettles; trailers for open-hearth ladle cranes; gasoline pump for oil house, and vacuum trap. For the first prize suggestion $25 is given each month and for second prize, $15. In the bulletin the names of the winners are printed.

Safety Rules for Iron and Steel Plants

Proposed Code of the Industrial Commission of Ohio for Coke Ovens, Blast Furnaces, Steel Works and Rolling Mills

The Industrial Commission of Ohio has before it a code of safety rules and regulations governing the operation of blast furnaces and steel plants and has published these in pamphlet form. A similar code proposed by the same commission relates to foundries and to the employment of women in core rooms. These sets of rules, as prepared by sub-committees, have been approved by a general advisory committee, but have yet to be approved by the Industrial Commission. They are being sent to foundries and steel plants in Ohio and about two months' time will be allowed for the receipt of criticisms and suggestions from operating companies. Considerable portion of the regulations relating to foundries have been printed in these columns in connection with reports of meetings of the sub-committee formulating them. THE IRON AGE has also printed the foundry regulations of the State of Pennsylvania (issue of Oct. 21, 1915, page 955) embodying many of the regulations that are now recommended for Ohio by a foundry sub-committee consisting of H. J. Boggis, chairman, Fred L. Baumgartner, J. F. Sords and John R. O'Leary. The general safety advisory committee of Ohio is headed by S. P. Bush, president Buckeye Steel Castings Company, Columbus. The committee on steel mills consists of L. H. Burnett, Carnegie Steel Company, chairman; George M. Verity, American Rolling Mill Company (represented by C. R. Hook, general superintendent), and two representatives of labor organizations, Ed. McLean and Abraham Garfield, both of Youngstown. The proposed regulations for blast furnaces and steel works are as follows:

BY-PRODUCT COKE OVENS

1. Hoppers should be guarded in such a manner as to prevent man from falling.

2. Exposed moving parts of coal and coke handling machinery to be guarded as prescribed by general code. (It is recommended that grease cups be extended to the outside of the guards to facilitate oiling.)

3. Some method of shutting off power to be installed near coal hoppers to enable workmen to shut down hopper shakers in case of accident.

4. All approaches leading to rooms or buildings where coal dust or gas may accumulate to bear warning signs forbidding smoking or open lights.

5. All elevated walks, stairways and platforms to be guarded by standard railing. (Note exception under Rule 6.) Would recommend that "standard railing" be specified as follows: To be not less than 3½ ft. in height, with intermediate rail midway between top rail and floor, and shall have toeboard or toe-plate at base at least 3 in. in height.

6. Exception to Rule 5 to be made for platforms at both front and back of coke ovens.

7. Quenching cars and larry cars to be equipped with automatic warning signals.

8. All power transmission machinery to be guarded by standard guards.

9. Reversing machines and counterweights on oven platforms should be enclosed by solid or mesh guards.

BLAST FURNACES, DOCKS AND ORE STORAGE YARDS

Section A.—General:

1. These rules are intended to cover the fundamental safety requirements for blast furnaces, cast houses, stoves, gas cleaning apparatus, skip hoists, pig casting machines, stock houses and stock handling machinery.

2. Valves, switches and operating levers that control the movement of machinery covered by this code shall be provided with devices which will permit them to be locked.

3. Standard platforms, provided with permanent stairways or iron ladders, shall be installed at all elevated points where employees daily or frequently are required to go. This rule shall not apply to railroad structures.

4. Some means for the quick resuscitation of men overcome by gas shall be provided at the blast furnaces.

5. A signal system shall be maintained between each blast furnace and its blowing engine room.

Section B.—Blast Furnaces:

1. Each blast furnace shall be equipped with a telephone or speaking tube connecting the top of the furnace with the cast house or blower's office. It is also advisable to have a means of quick communication between the cast house or blower's office and skip hoist operator's house.

2. A removable shield constructed with a hole for the movement of the drill shall be provided when tapping the iron hole.

3. The mud gun shall be equipped with a funnel shaped guard at least 6 in. high around the receiving hole of the mud cylinder.

4. For all new construction, explosion doors on top of the furnace shall be of the bleeder type only, and so constructed as to prevent, as far as possible, the escape of anything but gas and fine material.

5. Platforms shall be provided for all bleeder valves, and wherever practicable such platforms shall be standard.

6. Bustle pipes shall have a railed walk with toe-boards and shall be equipped with stationary stairs or steel ladders.

7. Provision shall be made to protect persons underneath the skip car tracks from falling material.

Section C.—Stoves:

1. Means shall be provided so that before men are permitted to enter stoves for any purpose, the cold blast and gas burner valves must be locked shut, the chimney valve locked in proper position and the operating mechanism to the hot blast valve disconnected or locked.

2. All manholes at or about the top of each stove shall be provided with platforms accessible by stairways or permanent ladders.

Section D.—Cast Houses:

1. Casting holes where ladles are loaded under the floors, shall be railed, or where this is not practicable, a grating shall be provided.

2. Two or more exits from opposite sides or ends of cast houses shall be provided by runways or stairs. Where the cast house floor is elevated permanent or removable railings (not necessarily standard) shall be provided.

3. All permanent gates in iron and cinder runners shall be operated from a distance.

4. All men in cast house crews shall wear eye protectors. Men operating or walking about acetylene, electric or oxygen burning apparatus must wear colored eye protectors.

Section E.—Gas Cleaners:

1. All gas cleaners which may have to be entered while the furnace is in operation shall be provided with one or more valves by which then entering gas can be shut off.

2. Operating devices for dust catchers shall be arranged to enable the employees to dump them at such a distance and in such a location as to avoid the probability of being burned by hot dust.

Section F.—Stock Houses:

1. Scale cars and transfer cars shall be equipped with fenders or wheel guards, and warning signals.

Section G.—Pig Casting Machines:

1. Shields or shelter houses must be provided for protection of the men at the pouring end of pig casting machines.

2. All men at pig casting machines shall wear eye protectors during the pouring.

Section H.—Relining Precautions:

1. For relining purposes hooks on brick hoisting lines shall be designed so that in case of fouling, the hook will not be disengaged. The well through which material is hoisted to the working scaffold should be so constructed as to prevent the probability of the bucket fouling, and provided with a toe board around the opening of each platform.

Section I.—Ore Storage Yards:

1. Any live conductor bar or trolley wires, not a part of a machine, and so situated as to be touched by a person on the ground or permanent passageway, should be protected as far as practicable.

2. Track fenders or wheel guards shall be installed on all traveling ore handling machinery, except steam shovels, locomotive cranes, and other standard railroad equipment.

Section J.—Docks:

1. Life preservers and pike poles shall be maintained in

conspicuous and easily accessible places on all water front docks.

2. Snubbing posts shall, as far as practicable, be of a type that will lessen the probability of the lines slipping off.

BESSEMER DEPARTMENT OF STEEL PLANTS

These rules are intended to cover the fundamental safety requirements for Bessemer converters, hot metal mixers, cupolas, strippers and other equipment pertaining to the manufacture of Bessemer steel.

Section A.—General:

1. Valves, switches and operating levers that control the movement of machinery covered by this code shall be provided with devices which will permit them to be locked.

2. Standard platforms provided with permanent stairways or iron ladders shall be installed at all elevated points where employees daily or frequently are required to go. This rule does not apply to railroad structures.

3. All men engaged in the pouring or handling of molten metal or molten slag shall wear eye protectors.

4. Pouring platforms and other places where men are endangered from molten metal shall be provided with at least two exits.

Section B.—Hot Metal Mixers:

1. All mixers shall be equipped with counter balances or an automatic mechanical device which will either return the mixer to an upright position or prevent it from upsetting in case the power is off the tipping mechanism.

2. All mixers operated by hydraulic power shall be equipped with an emergency valve, so arranged that if the main operating valve fails while the mixer is pouring, the emergency valve can be operated immediately to prevent the mixer from upsetting or to return it to an upright position.

3. A warning signal shall be installed on each mixer to be sounded when the mixer is about to be poured.

4. Automatic rail stops shall be placed on either side of the opening of the hydraulic hoists used for conveying iron to mixers, and the opening in the floor caused by the raising of the hoist shall be guarded by automatic gates.

5. Auxiliary hoists on ladle cranes shall be equipped with a type of hook which can be attached by the craneman to tip the ladle after the ladle has been hoisted to pouring position.

6. There shall be a signal system between the mixer operator and the operator of the transfer ladle to notify the operator when the pouring is finished and the ladle is ready to be moved.

7. All cages on hot metal cranes shall be arranged to give protection to the cranemen in case of spilling or dropping a ladle of hot metal. The methods recommended are either to provide escape platforms on the outside of the building, which will be accessible from the crane cage, or to provide an enclosed fire-proof cage. Where an auxiliary enclosed fire-proof cage is installed for emergency purposes, it should be equipped with an auxiliary control for the bridge travel to allow the craneman to move the crane away from the immediate place of danger.

Section C.—Cupolas:

1. Cupolas shall be covered at charging floor level where men are working in cupolas, to prevent chargers from throwing in material, or material falling from stack onto men. These covers are to be constructed so as to allow ventilation to men working in cupolas.

2. Provision shall be made to cover openings between cupola shell and charging floor.

3. Drop chutes shall be enclosed as nearly as practicable. Preferably props shall be pulled by snatch block and cable, rather than by hand. Warning shall be given before bottoms are dropped.

4. When cupola cinder passes through hole in the floor, this hole shall be guarded by a suitable shield or railing.

Section D.—Ladles:

1. All ladles shall be bottom heavy, and ladle cars shall be equipped with safety devices to prevent ladle tipping.

2. Iron transfer ladles shall be provided with a warning signal.

Section E.—Vessels:

1. A signal shall be provided to give warning whenever a vessel is to be turned up or down.

2. A signal system operated from the scrap charging floor shall be installed to give warning when the vessel is about to be charged with scrap. Signal shall also be sounded when the charging of scrap is finished.

3. The hydraulic mechanism operating the vessels shall be equipped with an emergency valve so arranged that if the main operating valve fails while the vessel is pouring, the emergency valve can be operated immediately to control the movement of the vessel.

4. Vessels shall not be blown into stacks.

Section F.—Handling Molten Metal:

1. Hydraulic pouring cranes shall be equipped with safety automatic devices that will hold the crane jib and ladle suspended in pouring position if the pressure should fail.

2. The uncapping stand shall be equipped with a barrier to provide cooling of the ingots before they are uncapped.

3. Ingot mold cars shall be equipped with coupling devices designed so that it will not be necessary under ordinary conditions for men to stand between the cars to couple.

Section G.—Bottom House:

1. A mechanical means shall be provided for removing material from dry and wet mixers while they are in motion.

OPEN HEARTH, CRUCIBLE AND ELECTRIC FURNACES

1. Tapping platforms, charging floors and other elevated points should be guarded by standard rails with the exception of pouring platforms.

2. The opening in railing at tapping platforms for spouts or runners to be provided with a suitable removable guard to protect same when not in use.

3. Charging machines must be provided with warning signals.

4. When tearing out a furnace beneath the floor a tight boarding must be built around the furnace to prevent material from falling on workmen below. This should apply when a furnace is to be completely torn out and the uptakes and division walls removed, otherwise a floor in the uptake is sufficient.

5. Provision shall be made such that when a furnace is down for repairs the gas can not be accidently turned into the furnace.

6. All cages on hot metal cranes shall be arranged to give protection to the cranemen in case of spilling or dropping a ladle of hot metal. The methods recommended are either to provide escape platforms on the outside of the building, which will be accessible from the crane cage, or to provide an enclosed fireproof cage. Where an auxiliary enclosed fireproof cage is installed for emergency purposes, it should be equipped with an auxiliary control for the bridge travel to allow the cranemen to move the crane away from the immediate place of danger.

7. In new construction, charging buggies shall be equipped with coupling devices designed so that it will not be necessary under ordinary conditions for men to stand between the cars or pans to couple.

8. Provision shall be made such that when a producer is shut off from a main pipe or when furnace is cut out, gas can not be accidentally turned on again.

9. In crucible practice a safety cable or chain shall be provided at the edge of pouring platform to prevent men engaged in pouring from falling into ladle.

BLOOMING, BILLET, PLATE, BAR AND MECHANICALLY OPERATED MILLS

1. Subways or bridges shall be provided when passageways across tables, conveyors or other mill machinery are required.

2. All gearing or dangerous shafting on roll tables shall be guarded.

3. Coupling boxes, spindles and wabblers shall be guarded.

4. Suitable means shall be provided for reaching the top of housings.

5. Guards should be placed at the dead end of all roller tables to prevent material over-riding the end of the table.

6. Scale tunnels shall be arranged so that scale can be removed without subjecting workmen to danger of falling hot scale, or if this is not practicable, men shall not go in pit when mill is in operation.

7. Wherever practicable means shall be provided to protect men working about the rolls from flying scale and cinder.

8. Power must be shut off pit covers while soaking pits are being repaired.

9. The sides of bosh tank for quenching crane dogs shall be not less than 36 in. above the floor level.

10. Counterweights must be guarded.

11. Means shall be provided to warn the engineer of overspeeding reversing engines.

12. It is recommended that straight running mill driving engines of 100 hp. or over, be provided with a speed limit control and engine stop.

13. Valve, switches, and operating levers that control the movement of machinery covered by this code shall be provided with devices which will permit them to be locked.

14. It is recommended that all platrorms, runways, aisles, doors, stairways or ladders be kept as clean as possible.

HAND OPERATED MERCHANT AND ROD MILLS

1. Spindles, coupling boxes, pinions and wabblers to be guarded.

2. Danger from uneven or broken floor plates or gratings to be eliminated as far as possible.

3. Subways or bridges shall be provided when passageways across hot beds, runways, spindles or tables are required.

4. Adjustable guards to be provided at outside of hot beds and skids to prevent material falling off.

5. Hot and cold saws shall be guarded, and means be taken to reduce the number of flying sparks.

6. On small mills where long bars are being rolled in more than one pass at a time, safety posts to be used where practicable, to protect roll hands from being caught in the loop.

PIPE MILLS

Section A.—General:

1. These rules are intended to cover the fundamental safety requirements for lap weld mills, butt weld mills, coupling shop, galvanizing plants and all other equipment pertaining to the manufacture of pipe.

2. Standard platforms, provided with permanent stairways or iron ladders should be installed, where practicable, at all elevated points where employees are daily or frequently required to go. This rule does not apply to railroad structures.

3. All machinery, not otherwise mentioned and covered by this code, is to be safeguarded as specified for rolling mills or in general code.

4. Charging and discharging openings in welding and heating furnaces should be provided with shields to protect men from heat and flames.

5. There should be a signal system between the charging and drawing ends of all bending and welding furnaces.

6. Welding and sizing machinery should be protected as prescribed for rolling mills.

7. Hot and cold saws shall be guarded, and means be taken to reduce the number of flying sparks.

8. Moving parts of threading and finishing machinery should be guarded as prescribed under general code.

9. A means should be provided to notify operators around the furnace when gas is to be reversed.

Section B.—Gas Producers:

1. All openings level with the ground, used for burning out gas flues, should be protected by railings or gratings when flues are being burned out.

2. When men are engaged in repairing gas producers or gas flues, when other producers in the same battery are in operation, suitable gates or valves shall be provided, by which all gas can be shut off.

Section C.—Lap Weld Mills:

1. Solid welding balls should not be used, as holes for the passage of gas should be provided.

2. Forced ventilation should be provided for the men working in intense heat.

3. Space between ends of troughs, conveyors, or tables and roll stands should be barred to prevent passage.

Section D.—Butt Weld Mills:

1. Movable draw benches and chains should be so constructed or guarded as to protect men's feet.

2. Stops or guards should be provided at the delivery end of cross roll troughs.

Section E.—Galvanizing Plants:

1. Where practicable, all tanks shall be protected.

2. Special attention shall be given to the ventilation of galvanizing plants to remove as much of the fumes and steam as possible.

3. Galvanizing kettles shall be railed or shielded.

Section F.—Coupling Shop:

1. Shields should be provided at welding hammers and rolls to reduce the number of flying sparks.

2. All coupling shop machinery should have the moving parts guarded as prescribed under General Code.

Section G.—Job Shop:

1. All machinery used for special work in job shops should have the moving parts guarded as prescribed in the general code.

WIRE MILLS

These rules are intended to cover the fundamental safety requirements for the wire drawing, rolling and fabricating departments of wire mills.

1. Standard platforms, provided with permanent stairways or iron ladders, should be installed, where practicable, at all elevated points where employees daily or frequently are required to go.

2. It is recommended that all platforms, runways, aisles, doors, stairways, ladders, fire escapes, or fire apparatus be kept as clean as possible.

3. Where practicable, all tanks or tubs should be protected.

4. Wire drawing, rolling and fabricating machines shall be equipped with means, conveniently located for quickly shutting down the machinery in case of emergency.

5. Screens or railings should be provided to protect open pot annealing furnace while being repaired or not in use.

6. Passageways under hot wires from annealing furnaces shall be protected.

SHEET AND TIN MILLS, TINNING AND GALVANIZING

1. Shearmen, openers, loaders and machine feeders should be required to wear gloves or hand leathers, and proper protection to the forearm.

2. It is recommended that all tools, furnished either by the employer or the workmen should be kept in a condition of good repair and it is the workmen's duty to report all unsafe tools or equipment to his employer.

3. It is recommended employees should take proper precaution to prevent cold or wet objects coming in contact with molten metal.

4. Workmen shall wear eye protectors when grinding, chipping and attending galvanizing pots and tinning pots, unless other protection is provided.

5. Standard railings shall be provided around flywheels and drives. Cross-overs or bridges with hand rails should be provided when passage from one side of the mill to the other is necessary.

6. Wabblers on the end of the roll train shall be guarded, also the entering side of mill couplings when more than one roll is driven.

7. Shields shall be placed over furnace doors to protect workmen from heat.

PUDDLING MILLS, BUSHELING OR SCRAP FURNACES

It is recommended that the following shop rules be adopted:

1. When furnaces are to be fired, the dampers must always be pulled up before the blast is turned on.

2. Before charging a furnace, the cinder on the bottom of the furnace shall be permitted to cool off until it is non-fluid.

3. All obstructions must be cleared off the standing before charging a furnace.

4. When tools are taken from the bosh, they must be dried off before placing in hot metal.

5. When throwing scale into the heats of hot metal, care must be taken to see that the damper of the furnace is pulled up its full height.

6. After a heat of iron has been drawn from the furnace, the damper must be pulled up or adjusted to full draft before cooling off or fixing the furnace.

7. When throwing water into a furnace to cool off the cinder, it should be used in small quantities and extreme care taken to see that there is no bosh cinder or other solid bodies in it. At no time is any wet or damp material to be thrown into a furnace when there is melted cinder on the bottom of the furnace, when the damper is down, or the draft is shut off.

8. The throwing of water on balls of iron when taken out of furnaces to the hammer or squeezer is strictly forbidden.

9. No water shall be allowed to accumulate on the standings of furnaces, or along the mill races that the hot iron is run over to the squeezer or hammer.

10. In putting iron in the squeezer, great care must be exercised not to put the basket or tongs between the drum of the squeezer and the ball. In the event tongs or baskets are caught the workmen must let go of same at once.

11. Furnaces are not to be fired without slacking the blast sufficiently to keep flames from the fire chamber burning the men working about the furnace.

12. Hot taps must not be placed near water.

13. When dumping tap buggies, care must be exercised to not allow cinder to come into contact with damp or wet ground.

14. Water must not be thrown on hot taps.

General

1. All bloom boys and roll hands must wear goggles or copper wire face masks.

2. All dampers and doors on furnaces must be properly balanced and balance weight must be adjusted by the workmen and securely fastened each time.

3. Where switches are in use on a telepherage system sufficient light must be provided by which to change switch.

4. When ash pits are two or more feet deep, safe and substantial means of access to and egress from pits shall be provided.

5. Muck mills shall be protected in accordance with rules pertaining to hand operated rolling mills.

The stockholders of the Trumbull Steel Company, Warren, Ohio, at a meeting held Feb. 23, authorized an increase in the capital stock from $4,000,000 to $10,000,000. Plans for the building of an open-hearth steel plant will be considered at a future meeting. Directors were elected as follows: Jonathan Warner, Philip Wick, John C. Harrington, D. W. Kerr and W. P. H. Ward.

Plant Expansion of Norton Companies

A new grinding wheel plant, known as plant 6, was opened by the Norton Company, Worcester, Mass., Jan. 17. It is a plant complete in itself for the manufacture of grinding wheels from the artificial aluminous abrasive marketed by the company under the trade name of alundum. Much attention has been given to its architectural features, as it will form the nucleus for the future expansion of the wheel-making plant at Worcester.

The new plant is located on Gleason Avenue, a short distance from the older buildings of the company on New Bond Street. It has necessitated the construction of new streets and new railroad sidings and the building of much special machinery for its equipment. The main building is 60 x 176 ft., four stories. Parallel with the main building and connected with it by two covered passageways is a two-story kiln building, 80 x 352 ft., with provision for seventeen kilns, thirteen of which have been completed. Adjoining the kiln building is a coal pocket, 38 x 352 ft. in size. The kiln stacks are of more ornamental design than any previously built by the company. The plant is equipped with hydraulic elevators, modern locker rooms with individual lockers of generous size, separate wash bowls, hot and cold water and shower baths. The interiors are painted olive green and glossy white.

The company has also recently put into use a large concrete building with brick exterior which is devoted to the testing, inspection, packing and shipping of its products. The second floor contains the grading, bushing, balancing, testing and part of the inspection department, and a tunnel leads from this floor under the railroad tracks to plant 1, enabling the electric trucks which are used throughout the plant to run directly into the building. Another building recently occupied is a five-story addition to the abrasive mill, which adds largely to the crushing and grading facilities. Additional crushing equipment will be installed in a four-story building now in process of erection on the Gleason Avenue site. On the opposite side of New Bond Street from the plant of the Norton Grinding Company, work has been started on the construction of a six-story warehouse, 64 x 80 ft., which will form a head house for a machine repair and carpenter shop, 80 x 208 ft., two stories. The second floor will take the form of a balcony to provide a craneway for the machine shop.

Last fall the capital of the Norton Company was increased to $3,000,000, and part of the new issue was used to take over the stock of the Norton Grinding Company, which has always been owned by the same interests. This branch of the Norton activities is just beginning operations in a new two-story addition, 124 x 280 ft., which has two 40-ft. craneways running its entire length. It has also built a new hardening house about 40 x 40 ft., one story.

In addition to the additions to the Worcester plant the company is building a new electric furnace plant for the production of alundum, close by its crystolon plant at Chippewa, Can., across the river from Niagara Falls. This new plant will have about one and one-half times the capacity of the present alundum plant at Niagara Falls, which will also be continued. The raw material plant at Bauxite, Ark., for the first preparation of bauxite ore, is also being doubled in capacity.

This New Norton Grinding Company Addition Has Two 40-Ft. Craneways Extending the Entire Length of the Building. Equipment was just being installed when this photograph was made. The balconies on three sides are used for machining operations with the lighter machine tools.

Deere & Co. Have a Profitable Year

Deere & Co., implement manufacturers, Moline, Ill., have issued their annual report for the fiscal year ended Oct. 31, 1915. This report is much more favorable than the one for the preceding year. The net income, including all subsidiary companies, was $3,248,023.57, against $2,085,079 in 1914. The surplus after the payment of preferred dividends was $600,028.57, against a deficit of $562,916 in 1914. While the sales in 1915 were about 12½ per cent below those of the previous year, the profits were considerably larger because of economies put into effect in factories and branch houses and also because the factories produced a greater proportion of the sales than in 1914, when stocks were large. The net working capital shows an increase of $1,232,242.67. During the year the company sold to the French Government commissary and hosptial equipment, consisting of ambulances, wagons, carts, etc., to the value of $1,923,000. This equipment was built during the quiet period of factory operations and thus was of material benefit to the company and its employees.

The Eastern Car Company, New Glasgow, Nova Scotia, has received an order from the French Government for 2000 cars in addition to the 1000 cars now under construction.

The Control of Chill in Cast Iron*

Variation in Total Carbon the Principal Cause of Disturbance in Malleable Castings and Chilled Carwheels—Use of the Open-Hearth Furnace

BY GRAFTON M. THRASHER

Several years ago, while I was chief chemist for a malleable-iron company, it occurred to me that the mere regulation of silicon was not sufficient to produce the desired degree of chill. But only after repeatedly encountering this fact in both open-hearth and air-furnace, as well as cupola metal, was I led to regard variation in the total carbon as the principal cause of disturbance; and I resolved to determine the total carbon as well as the silicon in every heat, and by a carefully prepared test piece to gage the approximate degree of chill.

The test piece selected was a round plug, 2 in. in diameter and 12 in. long, cast on end in green sand. It was allowed to cool at least 2 hr. in the mold before being cooled in water and broken in the middle; and the fractures were designated as gray, low mottled, mottled, high mottled, and white.

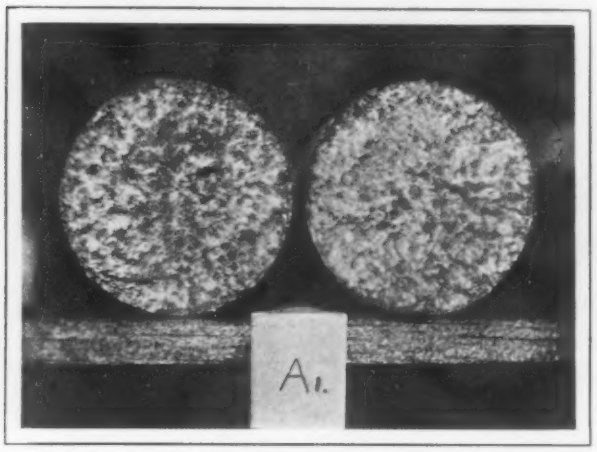


Fig. 1—Cast-Iron Test Plug Showing Low-Mottled and Mottled Fractures

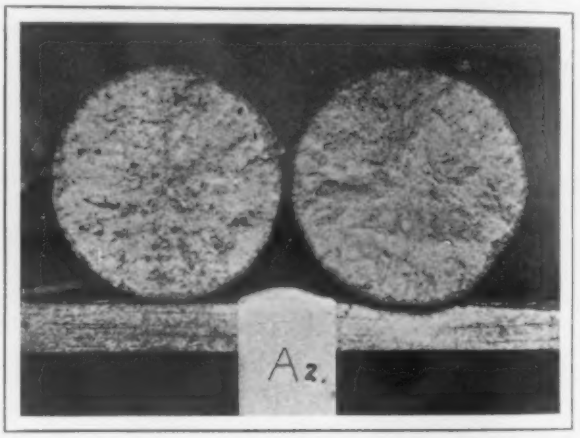


Fig. 2—Cast-Iron Test Plug Showing High-Mottled and White Fractures

All these fractures except the well-known gray one are illustrated in Figs. 1 and 2. From the same ladle of iron from which the test piece was poured a shot sample was taken for analysis so as to represent the actual iron in the bar as near as possible; and the test in all cases was poured from iron taken from the furnace when about half emptied.

The principal disturbing influence on these tests is the fact (proved by experiment) that it is entirely possible to pour a mottled test and a gray test from the same ladle of iron, depending upon the pouring temperature.

In order to study the cause of the variations more systematically a chart was prepared for plotting the analyses with carbon as ordinates and silicon as abscissæ. It soon became apparent that the analyses corresponding to the test piece with average chill, designated as "mottled," were arranged along a diagonal line on the chart, with analyses corresponding to high and low chill at a more or less definite distance on either side of the line. It happened that about that time a heat had to be held pretty long in the furnace on account of a breakdown, and it became necessary to doctor it up with 50 per cent ferrosilicon to get the metal into pouring condition. The test piece from this heat was found to be just normal or what is designated above as "mottled," and the corresponding analysis was silicon 1.07 and carbon 2.47 per cent, which served admirably for one extreme of the chill line as drawn on the chart. Something to represent the other extreme was found in a pig of charcoal iron of the same dimensions as the test piece and having the proper degree of chill. More recently I have obtained data for a new high-silicon point in which the analysis was, silicon 1.25, carbon 2.25 per cent. The chart as finally constructed is shown in Fig. 3.

As the manganese in all of these heats ranged between 0.25 and 0.35 per cent, which is normal for air-furnace malleable, and as sulphur averaged about 0.06 per cent, it will be seen that these elements interfered but little with the results. The phosphorus, of course, was between 0.13 and 0.18 per cent and likewise had very little influence.

RELATION OF CARBON AND SILICON

In examining the chart it will be noted that while the line tends to curve somewhat, yet it is sufficiently straight through the usual range of analyses to permit the assumption for practical purposes that 4 points of carbon are equivalent to 3 points of silicon in the regulation of chill, when the silicon is above 0.70 per cent; and that below this about 2 points carbon are equivalent to 1 point silicon.

The value of this knowledge will be at once apparent to a malleable-iron foundryman, as it enables him to substitute large quantities of low-carbon material for his sprue in case of shortage of that material, thus:

It is desired to substitute steel containing silicon 0.10 and carbon 0.30 per cent for 1000 lb. of sprue containing silicon 0.80 and carbon 2.80 per cent.

Equivalent deficiency of silicon in the steel due to low carbon = $(2.80 - 0.30) \times \frac{3}{4} \times 1000$ ..... = 18.7 lb.
Silicon deficiency = $(0.80 - 0.10) \times 1000$ ..... = 7.0

Total equivalent silicon deficiency 25.7

Therefore, it is necessary to increase the silicon in the mixture 25.7 lb. by substituting higher-silicon pig iron.

*From a paper presented at the annual meeting of the American Institute of Mining Engineers in New York, Feb. 16, 1916. The author is chief chemist and metallurgist, Haskell & Baker Car Company, Michigan City, Ind.

The popular conception of malleable iron accepts the limits of 0.60 to 0.90 per cent in silicon, with a very indefinite notion as to what the carbon content in the hard state should be; but a careful examination of this chart will show that for a given silicon percentage there is a definite carbon percentage, which is proper for each class of castings.

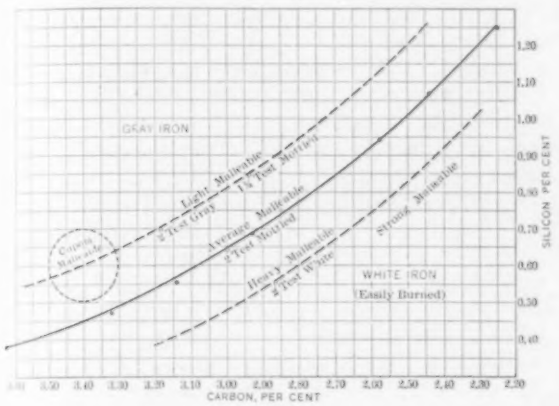


Fig. 3—Lines of Equal Natural Chill

In order to prevent cracked work and for other economic reasons, the malleable-iron foundryman runs his mixture as nearly gray as he dares, but if he desires to produce a very strong iron the presence of primary graphite in the hard iron must be avoided by lowering either the silicon or the carbon or both. As to malleable iron produced with the same average chill but with varying analyses, it will be found that the high-silicon, low-carbon mixture is more sound and reliable, but possibly a little less fluid, while the high-carbon, low-silicon mixture is subject to greater shrinkage and segregation, which produce weakness.

The principal consideration for the foundryman is to produce that type of structure which is necessary to obtain malleability upon annealing; and the chart shows the proper adjustment of silicon and carbon to bring about this desired result for the different grades of work. It will be further noted that, of the three factors considered, namely, silicon and carbon content, and chill, if any two be known the other may be predicted approximately.

Malleable iron produced from the cupola is pretty well confined to the dotted circle shown on the chart. Its proximity to gray iron, as well as its position in the field of greater shrinkage, will account for its weakness, which is not due, as popularly supposed, to the higher sulphur content. As the carbon is automatically adjusted within this range by melting in the cupola, the regulation of chill must be effected by silicon alone. It is not feasible, however, to run a mixture lower than 0.50 per cent in silicon because the cutting action of the slag thus produced is very hard on cupola linings. Good malleable castings are produced along the whole length of the charted lines; but the average foundryman, with his limited knowledge of conditions to be met in another foundry, cannot see how the other party makes a certain casting with 0.90 silicon while he finds it necessary to make it with 0.60 silicon. It is hoped that the publication of this chart will clarify the matter. The lines here given have been confirmed by plotting hundreds of analyses of mixtures of known chill and normal pouring temperature and the chart has been found a valuable aid in practical work.

Regarding the strength of malleable iron produced from irons of varying degree of chill, the following data, charted in Fig. 4, from test bars poured every other day for two weeks, will give a good idea of the effect of this factor:

Bar No.	Tensile Strength, per Sq. In.	Elongation, Per Cent	Silicon, Per Cent	Carbon, Per Cent
1	43,680	10.0	0.94	2.58
2	44,770	9.5	1.04	2.50
3	48,340	10.5	0.98	2.45
4	49,710	13.0	0.88	2.41
5	49,440	12.0	1.03	2.30
6	48,080	11.0	0.92	2.38

These test bars were round, 0.8 in. in diameter for 2 in. in the middle, and enlarged at the ends for gripping. A shrink ball was cast on one end to insure soundness. An examination of the structure of two of these bars, Nos. 1 and 4, revealed the fact that the weaker bar showed a slight inclination to graphitic structure in the shape of the carbon particles.

The nearest approach that I have noticed to the co-ordination of such valuable facts as are above outlined is the paper published in the Proceedings of the American Foundrymen's Association about two years ago, by John Jermain Porter, in which he plotted silicon and combined carbon; but as he made no statement as to the size of the castings from which these results were obtained, it is probable that this factor was not kept constant, which of course would account for a great many irregularities. Also, no reference was made to the effect of the total carbon on the combined-carbon content, which, as may be seen above, is highly important.

For the purpose of comparing the "natural chill" with that produced when cast iron is poured against an iron chiller, a test was made which conformed to that used in a carwheel foundry, using the same pattern and chill box. A ladle of very hot low-carbon iron was treated with sufficient 50 per cent ferrosilicon, as calculated from the chart, to produce the same degree of chill as that of the iron used in carwheels. It was necessary to allow the metal to cool for several minutes in the ladle before pouring, in order that the temperature should approximate the practice in the wheel foundry, where the metal is not so hot when melted. The result of this experiment is charted in Fig. 4 as No. 7,

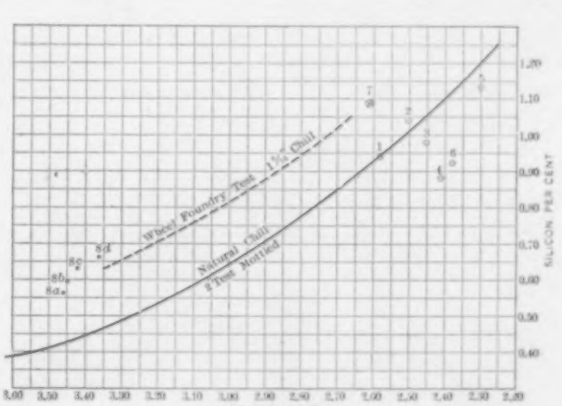


Fig. 4—Analyses of Bars Tested for Tensile Strength

while a regular test piece from a wheel mixture showing the same degree of chill (1 8/16 in.) is charted as No. 8.

CARWHEELS FROM AN OPEN-HEARTH FURNACE

The significance of this experiment is that it points the way to the production of carwheels with high silicon, low carbon, and low sulphur by the use of an open-hearth furnace for melting. The rapidly increasing sulphur in the cast-iron carwheel of to-day, due to the remelting of old wheels, is a source of anxiety to both the manufacturer and the railroad. The percentage of cementite in the structure of such a metal would still be sufficient

to insure good wearing qualities and a higher percentage of silicon would insure soundness. The absence of large quantities of manganese sulphide, which is undoubtedly the cause of a large percentage of the defects in the tread, would be a strong argument in favor of such a metal.

The effects of manganese and sulphur must be considered together, since it has been shown by several eminent investigators that where present together in the proper ratio they exist as MnS, which, properly distributed, would be neutral and ineffective upon the chill or strength of the metal. In practical work it is found necessary to carry an excess of manganese above this ratio, to insure reliable metal. In cupola-melted irons where the carbon is high, an excess of from 0.05 to 0.10 per cent

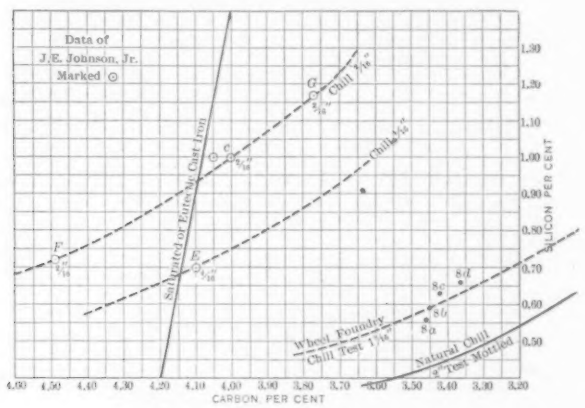


Fig. 5—Data of J. E. Johnson, Jr.

of manganese is sufficient, while iron melted in the air furnace or open-hearth requires from 0.10 to 0.30 per cent excess on account of greater exposure to oxidizing influences. It will be seen that where iron is properly melted to a fluid condition, the sulphur is fixed and without influence on chill, etc. If the 0.30 per cent excess manganese is figured to Mn_3C it will be apparent that it can affect only 0.02 per cent of carbon, which would have but small influence on the chill.

In my opinion the effect of sulphur on the chill, even when present uncombined with manganese, has been greatly exaggerated, and oxygen occurring simultaneously will be found responsible for this exaggeration.

Regarding the effect of phosphorus on the chill, it will be sufficient to cite Hatfield, who says, in discussing Stead's work on this element:

> Since, however, there is seldom more than 1.5 per cent of phosphorus present in pig irons used in foundry work, it may be considered that the influence of such percentages upon the condition of the carbon is negligible.

It will be seen that in the control of chill in malleable iron and carwheel mixtures, where this element does not exceed one-fifth of 1.5 per cent, its effect cannot be noticed.

EFFECT OF OXYGEN ON THE CHILL

Though I have not made an independent investigation of the effect of oxygen on the chill, I am inclined to believe from the data at hand that its effect is mainly qualitative rather than quantitative. While I fail to agree with some of the conclusions of J. E. Johnson, Jr., on this subject, I think his theory of the existence of an oxy-sulphide is true. In fact, a close analysis of Mr. Johnson's data brings out more forcibly my contention, namely, that the quantitative control of chill in commercial cast irons, aside from the physical effects of casting temperature, size of test, and size of chiller, is practically dependent upon the percentages of silicon and total carbon present.

In support of this statement, a chart, Fig. 5, is offered, in which Mr. Johnson's data are tabulated. His *A* and *B* series, not having a measurable chill, have been left out. It will be noticed that his *G*, *C*, and *F* series, forming a line for ⅛-in. chill, and his *E* on a line representing ¼-in. chill, are in perfect agreement with my data, shown in the lower right-hand corner, and all lines verge toward the point representing 6.67 carbon and no silicon. While his specimen *D* does not seem to agree with this theory, it is entirely possible that it may not be in its proper position, either because of error in analysis, making silicon or carbon too low, or because the sample was not representative; though a larger test pig than usual, or very low pouring temperature, would cause the specimen to show no chill.

TESTS OF PIPE CONNECTIONS

Results at University of Kansas with Oxy-Acetylene Joints and Screwed Fittings

In the spring of 1915 three senior students in mechanical engineering at the University of Kansas performed a series of experiments under the supervision of F. H. Sibley, director of the Fowler shops, to determine the strength of welded pipe connections as compared with screwed connections of equal size and with the original pipe material. The specimens, which were furnished by the Oxweld Acetylene Company, Chicago, Ill., were cut from standard weight black pipe made by the National Tube Company and ranged in size from ½ in. in diameter upward.

The specimens included two pieces of the original pipe, four butt welds, two connections made with malleable iron screwed couplings, three welded tees

Relative Strength of Welded and Screwed Pipe Connections

	Size of Pipe, In.	Average Maximum Load, Lb.		Relative Strength Welded
		Welded Connection	Screwed Connection	Screwed Per Cent
Tension tests of butt welds and couplings	½	10,222	9,040	113
	¾	21,367	13,835	154
	1	28,330	17,230	164
	1½	43,975	31,270	140
Compression tests of butt welds and couplings	2	72,500	58,150	125
Tension tests of welded and screwed tees	½	12,903	8,723	148
	¾	19,763	12,303	160
	1	30,007	17,550	171

and two made up with malleable iron screwed fittings. The straight samples were 18 in. long, while the tees were made with an 18-in. run and a 15-in. outlet. The pieces for the butt welds were cut at an angle of approximately 60 deg. in a pipe cutting machine to give the necessary V-groove for welding, and the tee welds were made by cutting a hole in the run and butting the outlet against the outside of the run, the welds in all cases being made by the company's operators.

The straight samples of ½, ¾, 1 and 1½ in. pipe were fitted with plugs to prevent the ends from becoming crushed by the jaws of the testing machine and were tested for resistance to tension in the usual way. The samples of 2-in. straight pipe were cut off to lengths of 5 in. with the ends square

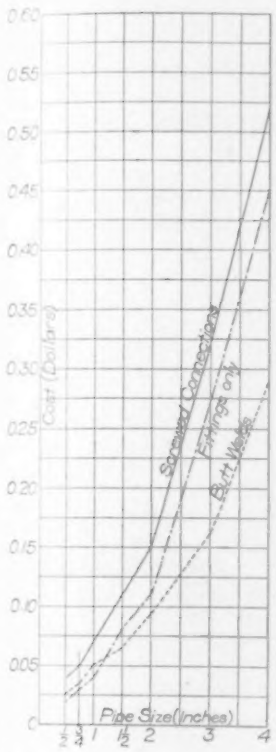
and were tested in compression. For the tee welds a holder was made to fit the run of the tee at either side of the joint, and the end of the holder was then placed in the upper jaws of the testing machine, while the outlet was held in the lower jaws and the sample tested in tension.

The behavior of the welded connections under tension corresponded closely with that of the original pipe specimens. Some of the specimens broke outside of the weld and some in, but all of the screwed connections broke at the last thread in the fitting. The 2-in. pipe samples tested in compression bulged out on either side of the weld or split along the seam in the pipe as far as the butt weld, which held without splitting. One of the screwed fittings sheared the threads and telescoped, while the other bulged outside of the fitting. In most cases the welded tee connections broke in the outlet at some distance from the weld, while all of the screwed fittings broke in the casting.

In the tension and compression tests of the specimens of butt welded and unwelded pipe, it was found that the elastic limit of the former did not differ from that of the unwelded pipe, thus showing that elasticity was not affected to any appreciable extent by welding. The screwed coupling specimens broke without elongating because of the reduced cross-sectional area of the threads. The elongation of the 6-in. test sections was less for the welded than for the unwelded pipe, but this was better than for the screwed couplings which broke with no elongation.

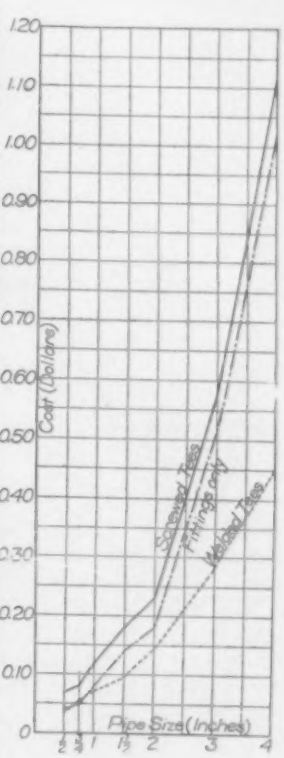
A summary of the maximum loads of the welded and screwed specimens tested is given in the accompanying table and from these average loads the relative strength of the welded and screwed connections has been computed. These figures show that the strength of the welded connections ranges from 13 to 71 per cent more than that of the malleable iron screwed connections which are assumed to 100.

The other table and the two accompanying curves show the cost of making pipe connections by the two methods. In computing these tables the cost of oxygen was assumed at 2c. per cubic foot and the cost of acetylene at 2c., which is the price if supplied in tanks. If generated acetylene were used the cost would be reduced, it is stated, more than half and as the cost of oxygen at the present time varies from 1½ to 2c. per cubic foot in different parts of the country, the figure of 2c. used in the table is conservative. Examination of the curves of total cost of welded and screwed connections and the cost of the fittings alone prove that the cost of the fittings is the principal item in the screwed connections, and in some cases the cost of the welded joint is less than that of the fitting, the lower cost of the welded joint being even more marked as the pipe sizes increase.



COST OF PIPE CONNECTIONS

PIPE SIZE		¼"	⅜"	½"	¾"	1"	1½"	2"	3"	4"
WELDED BUTT JOINTS										
TIME	MIN	3.	3½	4.	5.	6.	10.	15.	15.	
OXYGEN	CU. FT.	0.28	0.43	0.76	0.86	1.51	2.51	4.76		
ACETYLENE	CU. FT.	0.23	0.41	0.76	0.92	1.47	2.44	4.43		
WELDING WIRE	OZ.	0.08	0.15	0.20	0.30	0.50	1.00	4.00		
COST—										
LABOR	@ 30¢	$.0150	$.0175	$.0200	$.0250	$.0300	$.0500	$.0750		
OXYGEN	@ 2¢	.0056	.0086	.0152	.0190	.0302	.0502	.0952		
ACETYLENE	@ 2¢	.0046	.0082	.0148	.0184	.0294	.0488	.0886		
WELDING WIRE	@ 12¢	.0006	.0011	.0015	.0023	.0038	.0120	.0300		
TOTAL COST		0.0258	0.0354	0.0515	0.0647	0.0934	0.1610	0.2886		
SCREWED COUPLINGS										
COST OF FITTING		$0.02	$0.03	$0.04	$0.06	$0.11	$0.27	$0.45		
COST OF MAKING UP JOINT		0.02	0.02	0.03	0.05	0.04	0.05	0.07		
TOTAL COST		0.04	0.05	0.07	0.11	0.15	0.32	0.52		
WELDED TEE JOINTS										
TIME	MIN	4½	6.	5½	7.	8.	13.	22.		
OXYGEN	CU. FT.	0.41	0.61	1.05	1.34	2.26	4.02	6.93		
ACETYLENE	CU. FT.	0.35	0.58	1.01	1.29	2.20	3.84	6.50		
WELDING WIRE	OZ.	0.20	0.40	0.60	1.00	1.40	3.49	8.70		
COST—										
LABOR	@ 30¢	$.0225	$.0250	$.0275	$.0350	$.0450	$.0800	$.1100		
OXYGEN	@ 2¢	.0082	.0122	.0210	.0268	.0452	.0804	.1386		
ACETYLENE	@ 2¢	.0070	.0116	.0202	.0258	.0440	.0776	.1300		
WELDING WIRE	@ 12¢	.0015	.0030	.0045	.0075	.0105	.0405	.0712		
TOTAL COST		0.0392	0.0520	0.0732	0.0951	0.1447	0.2785	0.4598		
SCREWED TEES										
COST OF FITTING		$0.06	$0.05	$0.08	$0.14	$0.18	$0.51	$1.08		
COST OF MAKING UP JOINT		0.03	0.03	0.04	0.04	0.05	0.06	0.06		
TOTAL COST		0.07	0.08	0.12	0.18	0.23	0.57	1.14		



A Tabulated Statement of the Cost of Making Screwed and Welded Connections for Different Sizes of Pipes with the Relations Between the Cost of the Two Methods and the Fittings Expressed Graphically for Straight and Tee Joints

Low-Pressure System Condensation Outfit

For pumping condensation returns back into the boiler of a low-pressure heating system the Goulds Mfg. Company, Seneca Falls, N. Y., has placed a special outfit on the market. It consists of a single-stage centrifugal pump having a maximum capacity of 70 gal. per minute, directly connected to an electric motor mounted on the same bedplate. The tank, which has a maximum capacity of 60 gal., is mounted on a separate set of brackets to enable it to be placed wherever local conditions may dictate as being the most convenient.

A Fireproof Celluloid Eye Protector

A celluloid eye protector, made of a material called micalite, to which is ascribed all the properties of celluloid except that it will not burn, has been put on the market by Strauss & Buegeleisen, 489 Fifth Avenue, New York City. In the form of goggles the micalite may be supplied in two colors in the one piece, part amber colored and part clear.

Teran, Mahaney & Munro, Inc., a firm doing business in steam power, heating and ventilating work, has moved its offices to the Grand Central Terminal, Forty-second Street and Park Avenue, New York City.

Book Reviews

Forges and Furnaces in the Province of Pennsylvania. Written by members of the Pennsylvania Society of the Colonial Dames of America. Pages 204; 6¼ x 9½ in. Illustrated. Sold by John Wanamaker. Price $2.

The book is the third of the publications of the Pennsylvania Society of Colonial Dames of America and was prepared by its committee on historical research, being issued as the society's tribute to "the days of old in the years of ancient time." Original sources were consulted for information and verification, and among those who aided materially in this way are mentioned the late James M. Swank and B. F. Fackenthal. The aim of the writers of the various chapters has been to gather up the reminiscence and recorded data of some of the locally famous forges and furnaces in eastern Pennsylvania. The illustrations, which for the most part are photographic, are largely reproductions of old-time stove plate produced at the various furnaces whose history is detailed. Some of these have an artistic value quite equal to their historic value. Among the women who have contributed to the book are descendants of the original owners of the forges and furnaces described. The volume is exceedingly interesting and the typography, paper and illustrations all add to its attractiveness.

Practical Perspective. By Frank Richards and Fred H. Colvin. Pages, 64, 5 x 8 in.; illustrations, 64. Published by the Norman W. Henley Publishing Company, 132 Nassau Street, New York City. Price, 50c.

The book, which is now in its fourth edition, is a practical treatise giving the principles of perspective written in such a way that they can be understood and applied by a mechanic. It is intended also for the manager who has to make sketches to illustrate his instructions and the draftsmen who must turn in the finished drawing. It tells how to make all kinds of mechanical drawings in isometric perspective. In doing this a brick is taken as a start and the method is developed up to the sketching of irregular figures, such as five-pointed stars, etc. The use of isometric sketching paper by which it is possible to make a sketch in short order without using anything but a pencil is also explained.

Forging of Iron and Steel. By William Allyn Richards. Pages viii + 219, 5 x 8 in.; illustrations, 279. Published by the D. Van Nostrand Company, New York. Price, $1.50.

For students of forging in technical schools and for apprentices in forge shops this exposition of the subject is a simple but complete guide. The textbook style is adhered to, and the end of each chapter is given over to review questions that serve well to emphasize in the mind the important points just made. The illustrations are well selected to bring out quickly the gist of the text. Chapter one, a brief historic sketch of the use of iron and steel, does not add much to the usefulness of the volume but is of some interest. A course of exercises is appended that are well arranged to make the study of the book a good first step in this particular field.

Quin's Metal Handbook and Statistics for 1916. Compiled by L. H. Quin. Pages 182, 4 x 6 in. Published by the Metal Information Bureau, Ltd., 7 East India Avenue, London, E. C. Price, 3s. 6d.

This is the third annual compilation of statistics and data by Mr. Quin. It has to do with the production, prices, exports, etc., of copper, tin, lead, silver, spelter, antimony, alloys, nickel, tin plates, galvanized sheets, platinum, quicksilver, iron and steel, etc. Prices, of course, are given in pounds and shillings. Mr. Quin refers to the difficulties which the war has imposed on the collection of metal trade statistics, pointing out that some have been withheld out of deference to the British authorities, but his compilation is nevertheless interesting and useful to those who follow the metals in a statistical way.

Poor's Manual of Railroads for 1916, the 49th edition, covering United States, Mexico and Canada, has just been issued. A new feature in this high-grade publication is the presentation of the margin of safety of individual bonds and stocks in the form of the percentage of total net earnings remaining after interest and dividend payments. This information appears throughout the text in connection with the statements of the various companies. There has been a revision of bond descriptions, particularly with respect to the underlying security. The descriptions contain new italicized headings for interest, trusteeship, etc. The statements are all revised to June 30, 1915, and information issued prior to Feb. 10, 1916, is also included. The manual contains 3372 pages.

Heaton's Annual, the Commercial Handbook of Canada, twelfth edition, has just been issued by Heaton's Agency, Toronto. It is a Canadian book of easy reference, published yearly and gives directories of government officials, banks, insurance companies, steamships, railroads, rates for postal and parcel post service, cost of travel, customs tariff revised to date, descriptions of Canadian towns and cities and a shippers' guide. In this edition there has been developed a section aptly entitled "Where to Find It," which is an index of the more important contents of the Dominion and Provincial government reports and standard publications relating to Canada. By reference to this section, the reader can at once locate the information he wants.

"The Carbonizing and Briquetting of Lignite," by S. M. Darling, is a pamphlet recently issued by the government of the province of Saskatchewan, Canada. It is a report of investigations caused by the government of that province with a view toward better methods of utilizing lignite by way of drying, carbonizing and briquetting it to determine its value as a source of power, domestic and furnace fuel, and hydrocarbon and ammonia by-products. Excellent illustrations of various mechanisms for burning, briquetting and carbonizing this material are given. The statement is made that tests, which consumed 10 carloads of carbonized lignite, proved it equal to Pennsylvania anthracite for use in power-gas producers.

"Electrothermic Smelting of Iron Ores in Sweden" is the title of a bulletin issued by the Canadian Department of Mines and written by Dr. Alfred Stansfield. The data presented are based on a visit made by the author in June, 1914, to the three important works at which electric smelting of iron ores is in operation, to plants operating the Rennerfelt electric steel furnace and to an electric iron-smelting plant in Norway, operating the Tinfos furnace. The matter presented is very thorough, giving valuable operating and cost data on the Elektrometall, Helfenstein and Tinfos smelting furnaces as well as the Rennerfelt steel furnace. Unusually good illustrations are presented.

"Notes On the Uses of Low-Grade Fuel in Europe" is the subject of Technical Paper 123, issued recently by the U. S. Bureau of Mines. It is written by R. H. Fernald, professor of mechanical engineering, University of Pennsylvania, Philadelphia. It treats of the utilization of high-ash coals in non-by-product producer gas plants, of the use of wood refuse and similar material, of the size and character of European by-product plants, of the uses of tar, of low temperature distillation and of the slagging gas producer. A section is devoted to the use of powdered fuel, discussing the difficulties in applying powdered fuel, with details of English plants.

That the iron-bearing material in northwestern Louisiana is too scanty to be available for use under present conditions is the conclusion reached by Ernest F. Burchard in Bulletin 620-G of the U. S. Geological Survey.

Chicago Equipment Company's Report

The Chicago Railway Equipment Company, operating plants at Chicago, Ill.; Franklin, Pa.; Marion, Ind., and Grand Rapids and Detroit, Mich., has issued its twenty-third annual report, giving results of operations in the year ended Dec. 31, 1915. The balance sheet, as of Dec. 31, is as follows:

Assets

Real estate at cost	$283,076.45
Buildings and equipment at reproductive values, as shown by appraisals	1,716,524.27
Patterns, etc., at book values	54,302.24
Goodwill and patents	750,000.00
Inventories or finished product, work in process, raw materials and supplies	899,950.26
Investments at book values (market values unknown)	12,475.00
Accounts and bills receivable and cash in banks and on hand	631,972.67
Insurance premiums unexpired, prepaid interest, etc.	3,114.19
Total	$4,351,415.08

Liabilities

Capital stock issued	$2,486,000.00
Bills payable	200,000.00
Accounts payable and miscellaneous accrued liabilities	279,022.10
Dividend payable—due Jan. 1, 1916	44,753.53
Reserve for contingencies	10,000.00
Reserve for possible shrinkage in inventory valuations	45,000.00
Reserve for depreciation and accruing renewals	385,163.53
General reserve	500,000.00
Undivided profits	401,475.92
Total	$4,351,415.08

Dividends were declared during the year and charged to undivided profit account, totaling $174,020.

The accompanying remarks by President E. B. Leigh cover a wide range of subjects connected with railroad matters, in which, of course, the company is deeply interested. He discusses the influences bearing on the railroad situation and is mildly critical of the Interstate Commerce Commission and Federal Trade Commission. Extracts from other portions of his report are as follows:

"The business of the country, taken in its entirety, is unquestionably at a high level; in some lines, abnormally high, and with the effect of bringing the total average to a point which, in itself, is deceptive.

"The doctrine has been set forth that the railroads are an essential fundamental factor in general business prosperity. That is to say, railroad purchases, at least in normal measure, are a prerequisite to the stimulation of purchases in collateral lines, and which in turn are felt throughout the fabric of business generally.

"That we are now enjoying a large measure of prosperity in the face of the fact that the railroads did not buy, and are not now buying, in normal quantities, is in no sense a contradiction of this doctrine; on the other hand, it only emphasizes it.

"Railroad purchases have been much below normal, while the basic industry, 'steel and iron,' has found an unprecedented outlet for its products through unusual channels, thus, for the time being, completely distorting the relation of iron and steel to railroad requirements, and the relation of railroad purchases to general business prosperity. In spite of the high tide of business to-day, and as above defined, it is believed that it is not as general as many think; neither is it founded upon that stable basis which would exist were our railroads taking and absorbing their normal quota of iron and steel, instead of its going into war requirements, munitions and their many collateral directions incidental to the European war.

"The number of cars ordered in the United States in 1915 (exclusive of 18,222 foreign cars) was 107,796, as against 80,264 in 1914. One-half of the year's orders was placed after Oct. 1. The number of cars built in 1915 (exclusive of 14,128 foreign cars) was 59,984, as against 104,541 in 1914—the smallest number built in any year of record since 1899.

"This company's business is fairly reflective of what may be termed normal general business conditions. As illustrative of this: Of the total earnings for the year, 88 per cent was earned in the last half of 1915, and 57 7/19 per cent within the last quarter of 1915; while of the last half year's earnings, 66 6/10 per cent was made in the last quarter.

"Of that portion of the company's business not directly affected by steel and iron conditions, 93 per cent of earnings was made in the last half of the year, and 70 per cent in the last quarter, with 67 per cent of the last half year's earnings made in the last quarter; while in that department of the company where profits have been directly affected by these conditions, the entire earnings were made since July 1, and after absorbing a small loss to that date.

"It is confidently believed that if war business, direct or indirect, were eliminated from the railroad supply industries as a group, the average result would be as much below normal in that field as it surely would be in the general business of the country—with war business likewise eliminated.

"The present period of prosperity enjoyed by many of our important railroads, and their consequent recent large earnings, by no means affords a solution of the railroad problem, with which the railroads have had, and still have, to deal. The meager help given by the Interstate Commerce Commission would, under normal traffic conditions, be a small factor. Such improvement as they are now experiencing is not due either to regulation or to the rulings of the Interstate Commerce Commission, but in spite of them. How long this will continue may be measured by the duration of the causes which have wrought the change.

"This is equally true of our unnatural, illogical and contradictory business laws. Business is good in spite of them, and for causes never contemplated by our national legislators. Had they foreseen these conditions, it is by no means unlikely that we would to-day have statutes attempting to nullify or eliminate them.

"It is believed that the continuation of the present level of business is dependent upon the continuation of the European war. However, should the abnormal drain upon our steel industry be withdrawn it might make for larger purchases by the railroads by reason of more favorable deliveries and price, and thus operate to retain the level of general business.

"One of the very puzzling problems has been to forecast the iron and steel markets. Your company is fortunate, however, in having a large supply of all kinds of raw material, and bought at favorable prices. It is safe to say there is not a single item in the inventory that is not very much below the present market.

"Inquiry has from time to time been made as to our obtaining war business, particularly munition work. It may be stated that our company has not gone into this work, although it has had it under serious consideration upon several occasions. At no time, however, were the conditions such as to cause your board to deem it prudent to incur the risks involved.

"In the present congested condition of the steel mills throughout the country the Franklin plant is demonstrating its co-operative advantages to your company. Through it we are able to control our necessary supply of brake beam material; not only as to delivery, a vitally important item under present conditions, but as to regulation of cost. The outlook for the present year in this department is very encouraging.

"The Franklin brake beam plant was completed and put into commission during the year just past. It has turned out a considerable volume of Eastern delivery and foreign business, and will be of great value to your company.

"Both the Grand Rapids and Marion malleable plants are in most excellent condition, ably managed, and have been steady contributors to the year's earnings. Grand Rapids continues to do a large percentage of our own work; while Marion is being constantly bettered, and is reaching out for broader and more desirable lines. Both of these plants should show greatly improved results during the present year.

"On Jan. 1, 1915, this company paid its seventy-seventh dividend, being the seventy-fourth consecutive quarterly dividend paid, and without reduction. In the fifteen years from Jan. 1, 1901, to Jan. 1, 1916, the company has made net earnings of $5,662,005.80, or an average of $377,467 per year, equal to an average of 15 per cent per annum on the total present outstanding capital stock. This period covers at least four of the leanest years in the business world."

ESTABLISHED 1855

THE IRON AGE

EDITORS:
A. I. FINDLEY
GEO. W. COPE W. W. MACON
CHARLES S. BAUR, *Advertising Manager*

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The American Can Decision

Further progress has been made in judicially determining the application of the Sherman anti-trust act in the decision just rendered in the United States District Court at Baltimore in the suit of the Government for the dissolution of the American Can Company. Some details of this decision will be found on another page of this issue. The court does not follow previous anti-trust decisions, but pursues a wholly original method of disposing of the case. It might be considered as unsatisfactory from the standpoint of both prosecutor and defendant, as the judge refused either to decree the dissolution of the company or to dismiss the Government's bill. While the company is placed in an uncertain position, as the court proposes to continue jurisdiction over its affairs, yet this is far better than if a decree had been issued ordering dissolution to be made. Should the case be permitted to rest at this point by both parties, the company is left free to continue its business, and it may safely be assumed that it will be so conducted as to continue to merit the good opinion of the court thus retaining jurisdiction.

It is extremely interesting to note that, while the court takes cognizance of the fact that the organizers of the company violated the Sherman anti-trust act when they formed the company in 1901, this is not considered in itself as calling for the dissolution of the company under a suit begun in 1913, after years of commendable business behavior and after winning the favor of both its competitors and its customers. The judge said: "I am frankly reluctant to destroy so finely adjusted an industrial machine as the record shows the defendant to be."

All the prosecutions in anti-trust cases are now resolving themselves into inquiries as to whether the companies prosecuted are conducting themselves properly or whether they are engaged in practices in actual restraint of trade. The mere fact of size does not enter into the question as to whether these great corporations are to be dissolved or permitted to continue to exist. The rule of reason is increasingly prevailing in the application of the act ever since it was enunciated by Chief Justice White of the United States Supreme Court. There seems to be ample warrant for the conclusion of the New York *Times* that "it has now been abundantly settled that there is no thoroughfare in the courts for unreasonable prosecutions."

The Future of Steel Prices

Every one now admits frankly that the steel market is in an unprecedented position, but the natural corrollary to such a proposition, that the market is likely to let go from the present condition in an unprecedented manner, is not so generally recognized, for one already hears speculation as to when "the break" will occur. For months the majority opinion has been that the steel market would break at the close of the war, while now it is suggested that it may break before the end of the war.

High prices for a commodity naturally suggest an impending break, and generally the higher the prices the more clearcut the break. While the situation in steel is not one that is to be judged by precedents, it is to be noted that it has not been the habit of the steel market to "break" in the ordinary meaning of the term as applied to commodity markets. A lessened demand for steel has found the mills still provided with contracts, and they have been indisposed to cut prices sharply until they had squeezed all the tonnage possible out of the contracts. By reason of the new policy pursued in recent months the tonnage open to contract, over and above that which is definitely ordered and specified, is unprecedentedly small. One should expect, therefore, a lessened consumptive demand to be reflected more promptly in the course of steel prices than has hitherto been the case. Would that mean a pronounced and extensive break? Were buying to proceed in step with consumption, there might be a succession of declines, even interspersed with advances, and that would be unprecedented.

The course of the market will naturally be determined by the relation between the consumptive demand, at the prices asked, and the ability to produce, and this latter is not the "productive capacity" as ordinarily understood, for the reason that there may be limitations from lack of labor, transportation facilities or raw materials. The rate of consumption of steel is not necessarily shown by the rate at which buyers receive shipments, because at

one time or another they may be stocking up. During a period of advancing prices buyers always attempt to increase their stocks. Undoubtedly the attempt has been made in the past few months, and with success in some cases. It is the general opinion, however, that most buyers were slow this time in reaching the conclusion that steel was likely to become scarce, and thus they lost much time, and then when they did reach this conclusion steel became scarce so rapidly that they had little opportunity to stock up. Thus there is reason to believe that stocks in buyers' hands are smaller than they usually are at a time like this; hence the rate at which steel has been produced and delivered is a better measure than usual of the actual consumption.

As to the future the indications are much less sure. The fact that buyers have specified far ahead has been taken to indicate definitely known requirements; but this showing is not conclusive. It is well known that buyers have repeatedly asked mills to modify specifications already filed, and to change the order of shipment of different batches of specifications filed. It would appear that as to a large tonnage buyers have done some tall guessing; hence it does not follow that consumption in the future is to be gaged by the volume of specifications now on mill books.

That the consumptive requirements of the country are likely to grow may be taken as highly probable. The country is growing more prosperous, with greater and greater industrial activity, and the question is whether the requirements will be expressed in demand when prices are so high. Late in October last the average price of finished steel products reached a level with the top of the 1912 movement, and early in November they touched the top level of the 1909 advance. At the end of December they were at the same average level as obtained in 1907, while they are now about $7 per ton above that level. It cannot be shown, however, that it was high prices that caused demand to slacken after those historic price advances. In each instance, by the way, the mills insisted that they were holding prices from advancing to the point of cutting off consumption. To put it quantitatively, the question might be asked now whether steel prices $7 per ton above what was called a safe level in 1907 would operate to curtail consumption, and if so how much. Such an advance would mean a cost to the country of something more than $150,000,000 a year, on the material actually consumed at home. The remainder of the production is nearly all war steel of one description or another, in the case of which price is a secondary consideration. For so vital a necessity as steel an extra tax of $150,000,000 a year might not prove so very formidable.

If it were possible to inventory, even roughly, the lines of consumption of steel at present, with their respective tonnages, some definite idea might be had of the extent to which high prices might reduce consumption; for the cost of steel is a much more important matter to some buyers than to others. In the absence of such a compilation it is fair to say that it is possible to overrate the influence of price upon demand. As a general rule steel is bought simply because it is needed. When at various times buying has stopped, it has not been, in the last analysis, because prices had gone up, but because the buyers expected prices to go down. That is a different matter. Men do not conclude prices are going down because they have previously advanced, but because they see signs of weakness in existing prices or because they think they foresee causes that will operate to reduce them. Unless high prices, *per se*, are an indication that steel will become more plentiful, and that does not seem susceptible of proof, the indications are in the other direction. There is a large export demand awaiting better attention than the mills have been able to give it in recent months. The advent of spring should develop increased requirements in various directions. As to the supply of steel, there is danger of a shortage of ferromanganese and possibly of other raw materials, and there is the certainty of labor scarcity which may prove sufficient to affect the volume of production, while there is a possibility of transportation facilities proving insufficient.

Iron and Steel in Exports

While somewhat extended reference has been made to our iron and steel exports in the calendar year 1915 in THE IRON AGE (Feb. 17, pp. 428-9, 439; Feb. 24, p. 519) it may be of interest to show how the export rate of December compares with the export rate in the year as a whole, not only for iron and steel, but for manufactures which involve the consumption of more or less iron and steel. Such reference is particularly in point by reason of the fact that the exports reported by weight have fluctuated widely, and in a manner somewhat different from the exports of manufactures which are returned only in values. The tonnage exports increased continuously and rapidly until August, declining somewhat thereafter, while the total value of iron and steel exports continued to increase after August, the divergence being due in part to higher values later in the year for the tonnage products, and in part to there being much heavier exports of machinery and unloaded shells, the weight of which is not returned.

Not included in the category of iron and steel in the Government returns are certain manufactures involving the use of more or less iron and steel, such as agricultural implements, vehicles, including motor cars and trucks, freight and passenger cars, etc., and loaded shells.

On the assumption that the exports in December suggest the present pace more accurately than the exports in the whole calendar year, the following table is presented, showing the value of the calendar year exports and the percentage by which the December exports were above or below the average rate for the year.

Exports in 1915, and Proportional Rate in December

	Year 1915	December Above or Below Annual Rate
Iron and steel	$388,703,720	+41 per cent
Agricultural implements	13,555,473	+12 per cent
Automobiles and parts	111,180,139	—9 per cent
Freight cars	10,025,305	+233 per cent
Other vehicles	24,151,977	+53 per cent
Loaded shells, etc	89,114,134	+214 per cent

Prior to the war the exports of iron and steel manufactures represented a very considerable value, but they did not represent a large tonnage of iron and steel consumed. Prior to last year the largest tonnage exports in a calendar year were in 1913—

2,947,596 gross tons, the reported value of which was $112,534,577. The value of the iron and steel products not returned by weight in that year was $176,593,843, making a total of all iron and steel reported as such of $289,128,420. In the manufacture of these iron and steel commodities not returned by weight it is doubtful if as much as a million tons of iron and steel was consumed. The exports of manufactures not returned as iron and steel, but still employing some iron and steel in their manufacture, were relatively small in that year. In the calendar year 1915 the exports of iron and steel manufactures, and of other manufactures involving iron and steel, were very large, while in the case of most of the items the exports in December were at a much greater rate than the year's average, and thus while the tonnage exports in December were at the rate of 4,250,000 gross tons a year, the manufactures exported may have involved the consumption of almost as large an amount of iron and steel.

Property Rights

In the reply by Ralph Peters, chairman of the railroad companies' committee on railroad mail pay, denying the accusation that the railroads are lobbying against legislation urged by the Post Office Department, he said: "We are making a plea to the country in a fight for our very existence against the mistaken ideas of certain men in Congress who feel that they have the right to do what they please with the property of others, regardless of what the consequences may be." Mr. Peters, who is president of the Long Island Railroad Company, is justly indignant at the attempt made to stigmatize the railroads by accusing them of improper practices. The so-called lobbying consists in appealing through the press and by the distribution of literature to the fairmindedness of the public, finding that the Congressional committee having this matter in charge is determined to permit the Post Office Department to name the rates and all conditions of service for handling the mails, compelling submission to its orders by confiscatory fines. The railroads have asked that this matter be referred to the Interstate Commerce Commission as a proper subject for its consideration, inasmuch as the commission now regulates the rates allowed the railroads for all other forms of traffic, but this proposition was rejected, together with all other suggestions by the railroads.

Briefly, the objectionable Moon bill would enable the Post Office Department to carry on a commercial transportation business under the guise of parcel post, burdening passenger trains with freight, yet giving the railroads less for carrying such traffic than the Interstate Commerce Commission allows them to charge for similar service on freight trains. This is unfair treatment, and all owners of railroad stocks, bonds or other securities, also non-owners of such securities who believe in a square deal, should urge their Senators and Representatives to oppose the attempted legislation and have the whole question turned over to the Interstate Commerce Commission for the establishment of equitable rates.

President Peters, in assailing "the mistaken ideas of certain men in Congress who feel that they have the right to do what they please with the property of others," touches a weak point in our system of government. In the formulation of laws those who may be but temporarily intrusted with power as our representatives are too often actuated by a desire to please certain elements or special classes of the people. Laws have thus been passed and others are contemplated which so invade the right of an owner of property to the peaceful enjoyment of his own as practically to confiscate a portion of it. It is grossly unfair and unworthy of a people's government. Of all countries on earth, the United States should always be in the position of being pointed to as a conspicuous example of just treatment of citizens. Those whose thrift has enabled them to own and retain property should not be regarded by our law makers as inviting exploitation.

CORRESPONDENCE

Women Workers in German Electrical Works

To the Editor: The letter of C. A. Tupper, published in your Feb. 24 issue, is not entirely in accordance with my understanding of the facts. The article in your Jan. 27 issue was entitled, "What of German Industrial Conditions—The Lessons Which Industrial America May Learn in Its Efforts to Prepare for the Competition After the War."

The picture in Mr. Tupper's article, on page 243, was intended to show that "women have taken the places of men serving in the army," that "they will retain their positions after the conclusion of peace," and that "this is a factor which should be taken into consideration when the possibilities of dumping German goods on the American and other markets are discussed." In view of the intention of the author to show this, I call attention to the fact that the pictures on pages 243 and 245 were reproductions of photographs made for an album published by the Allgemeine Elektricitaets Gesellschaft in the year 1908.

It is therefore not correct to say "that a view similar to this appeared in an album of photographs taken before the war," but that these very same pictures which appeared in your Jan. 27 issue are identical with the views of the album published in 1908. It is common knowledge that the percentage of women workers in the electrical industry in the United States is just as large as the percentage of women in the corresponding German industries, if not larger, so that the conclusions reached are absolutely erroneous.

KARL GEORG FRANK.

NEW YORK, Feb. 24, 1916.

American-Built Dreadnoughts Accepted

J. W. Powell, president Fore River Shipbuilding Corporation, Quincy, Mass., received a cable Feb. 21, notifying the company of the final acceptance by the Argentine Republic of the super-dreadnoughts Moreno and Rivadavia. The cable stated: "Guarantee of one year in full service, super-dreadnoughts Rivadavia and Moreno, now expired, and both warships are accepted by Argentine Republic as thoroughly conforming to all specifications. Turbines have worked without hitch, each vessel having covered over 15,000 knots." The Moreno was built by the New York Shipbuilding Company, Camden, N. J., and the Rivadavia by the Fore River Shipbuilding Corporation.

The United Furnace Company, Canton, Ohio, which is building a blast furnace and by-product coke plant, has re-elected H. G. Dalton, Cleveland, president; H. R. Jones, first vice-president; E. A. Langenbach, second vice-president; E. P. Williams, treasurer, and E. L. Hang, secretary.

AMERICAN CAN NOT DISSOLVED

Court Decides Against Government, but Will Keep Jurisdiction Over Company

In the United States District Court at Baltimore, Md., Feb. 23, a decision was handed down by Judge Rose in the suit brought by the Government for the dissolution of the American Can Company for violation of the Sherman anti-trust act. The decision is wholly different from any previously rendered by the courts in anti-trust suits. Judge Rose takes original ground in announcing that he would not order the dissolution of the company, but would "retain the bill filed against it by the Government, and if the corporation at any time should do anything which will justify action of the court, there seems to be no reason why the Government should not then get the relief to which it should be entitled."

UNLAWFUL AT FIRST BUT NOT UNFAIR NOW

In arriving at this decision, the judge said that what had been proved by the evidence submitted was, first, that the defendant was organized to monopolize interstate trade in cans, and to attain that object such trade was unlawfully restrained by it, and by those who formed it and directed its earlier activities, and some of those individuals still participate in its management and control, but, second, for some time before the filing of the petition in this case it had done nothing of which any competitor or any consumer of cans complains, or anything which strikes a disinterested outsider as unfair or unethical.

The court holds that "while it had its origin in unlawful acts and thereby acquired a power which may be harmful, and the acquisition of which in any event was contrary to the policy of Congress as embodied in the statute, it for some time past has used that power on the whole rather for weal than for woe."

DISSOLUTION NOW WOULD PROBABLY PROFIT NO ONE

Following are further interesting excerpts from the decision:

"In this industry it is absolutely impossible to put things back where they were on March 1, 1901, and if it were possible probably highly undesirable.

"The defendant once sought to emancipate itself from the restraints of competition. Its power is great, but is limited by a large volume of actual competition and to a still greater extent by the potential competition, from the possibilities of which in the present state of the industry it cannot escape. Those in the trade are satisfied with it. They do not want it dissolved. Whether its dissolution would profit any one is doubtful.

"I frankly am reluctant to destroy so finely adjusted an industrial machine as the record shows the defendant to be. Yet the Government, too, has its rights, and thus far has been properly insistent upon them. The case most nearly in point is the United States versus the International Harvester Company. There is in that case a strong dissent from a very able judge. Nevertheless, the decision of the court cannot lightly be pushed aside.

"The Government recognized that the situation which existed before the defendant was formed cannot be restored. What it principally fears is that the defendant will, to the public prejudice, hereafter dangerously use the strength which it gained by its original lawbreaking. Defendant's reply that in that event it will be time enough for the Government to act does not fully meet the case. If this be dismissed upon its merits and without qualification defendant might be entitled to claim in any future proceeding that nothing in this issue may be used against it.

COURT TO RETAIN BILL AND RESERVE RIGHT

"Under the circumstances, would it not be better simply to retain the bill, without at present decreeing a dissolution, but reserving the right to do so whenever, if ever, it shall be made to appear to the court that the size and power of the defendant, brought about as they originally were, are being used to the injury of the public, or whenever such size and power, without being intentionally so used, have given to the defendant a dominance and control over the industry or some portion of it, so great as to make dissolution or other restraining decree of the court expedient?

"It is, of course, not suggested that this court should or could undertake the regulation of the defendant's business. Courts have no such power and no fitness for its exercise. What is proposed is in default of a better way of dealing with a somewhat unusual and very difficult condition."

The question of a decree being thus left open, it remains to be seen what will be done by counsel for the Government. The court stated that either side has the right to insist on a final decree, but it would appear that the Government would be more likely to demand one than the American Can Company.

Railroad Car Business

Though high prices are still advanced as reasons for postponing purchases of cars—with the Baltimore & Ohio in the case of 500 refrigerator cars and the Chicago & Northwestern in the case of 3500 cars as latest citations—there are still some 10,000 cars actively before the market and the following are the principal late settlements: Bessemer & Lake Erie, 750 hopper cars each to the Pressed Steel Car Company and the Standard Steel Car Company, 500 hopper cars to the American Car & Foundry Company and 500 gondolas to the Ralston Steel Car Company. The Pittsburgh Wabash Terminal Railroad, 550 hopper cars and 200 gondolas to the Pressed Steel Car Company. The Chicago Great Western, 200 center constructions placed with the Standard Steel Car Company.

The New York Central is getting prices on box and hopper cars and may buy more than 5000 cars. The Chicago, Burlington & Quincy has entered the market for 1000 box and 500 automobile cars; the Lakeside & Marblehead for 200 hopper cars; the Great Northern for 500 refrigerator cars and 25 tank cars, and Robert W. Hunt & Co., for 150 gondolas for the Canton-Hankow Railroad, China. The Atlantic Coast Line, it is expected, will close next week on its 900 cars.

Inland Steel to Build Another Blast Furnace

The Inland Steel Company, Chicago, has awarded contracts for the building of a third blast furnace at its Indiana Harbor works. The steel construction was awarded to John Mohr & Sons, Chicago. The new stack will be essentially a duplicate of the company's present second furnace, which has made an unusually satisfactory record, and will have a producing capacity of 500 to 600 tons per day. Contracts have also been placed for 44 additional Koppers by-product coke ovens and extensions of the benzol plant in keeping with the increased furnace and oven capacity. An additional steam blowing engine unit will also be installed. The possibility of being unable to secure the necessary plates for the construction of the furnace, which for a time threatened the undertaking, appears to have been removed, and construction work will proceed at once.

The Rateau Steam Regenerator Company, 140 Cedar Street, New York, has been awarded the following orders for steam regenerators: Union Gas & Electric Company, Bloomington, Ill., for regulating the discharge of exhaust steam in a water-gas generator; Sterling Salt Company, for regulation of the exhaust of a hoisting engine; Takata & Co., for regulation of reversing mill engines in Japan, and New Jersey Zinc Company for regulation of the steam flow of a hoisting engine.

The Sellers Mfg. Company, Chicago, is installing a scrap cleaning mill of the type built by the Sly Mfg. Company, Cleveland, Ohio, described in THE IRON AGE of July 1, 1915, and is erecting a new piling room to be equipped with overhead cranes.

THE SHIPBUILDING BOOM

Output of American Shipyards in 1916 Will Surpass Any Previous Year

WASHINGTON, D. C., Feb. 29, 1916.—An unprecedented boom in the shipbuilding industry is reflected in figures compiled by the Bureau of Navigation of the Department of Commerce, showing that on Feb. 1, 1916, there were in course of construction or under contract to be built in private American yards no less than 230 steel merchant vessels aggregating nearly 1,000,000 gross tons. These figures foreshadow an output for the industry for the fiscal year 1916 exceeding that of any year in the history of the country.

The geographical distribution of tonnage under construction is as follows: Delaware River, 65 vessels of 291,969 gross tons; Chesapeake Bay, 43 vessels, 221,406 tons; Pacific coast, 31 vessels, 173,178 tons; Great Lakes and rivers, 64 vessels, 142,163 tons; New England, 19 vessels, 68,078 tons; other yards, 8 vessels, 4577 tons. Five vessels of which the Bureau of Navigation has been notified have not been reported as to tonnage. The following table gives the number and gross tonnage of vessels building or under construction Feb. 1, 1916, by the companies named, both merchant and Government construction, the latter consisting chiefly of war vessels:

	Merchant Construction		Government Construction	
Name	No.	Gross Tons	No.	Displacement, Tons
New York Shipbuilding Co.	23	119,744	4	61,495
Newport News Shipbuilding & Dry Dock Co.	17	124,856	2	63,400
Fore River Shipbuilding Corporation	13	*66,000	22	*31,892
Wm. Cramp & Sons Ship & Engine Bldg. Co.	12	72,600	4	4,450
Dubuque Boat & Boiler Works	1	25	2	647
Charles Barnes Co.	1	300	2	720
Bath Iron Works	5	*1,900	4	6,295
Maryland Steel Co.	13	71,300	..	....
Harlan & Hollingsworth Corporation	15	63,381	..	....
Union Iron Works	19	140,658	..	....
Staten Island Shipbuilding Co.	6	1,697	..	....
Great Lakes Engineering Works	13	42,530	..	....
Baltimore Dry Docks & Shipbuilding Co.	7	24,500	..	....
Manitowoc Shipbuilding & Dry Dock Co.	4	1,000	1	1,000
American Shipbuilding Co.	14	63,300	..	....
Moore & Scott Iron Works	3	*10,000	..	....
Clinton Shipbuilding & Repair Co.	2	*560	..	....
Johnson Bros	..	....	2	800
Howard Ship Yards Co.	7	4,600	..	....
Seattle Construction & Dry Dock Co.	5	19,000	1	1,125
Lake Torpedo Co.	..	....	8	†....
California Shipbuilding Co.	..	....	6	*1,750
American Bridge Co.	16	10,388	7	1,955
Elicott Machine Corporation	3	750	..	....
Spedden Shipbuilding Co.	3	†....	..	....
Hartmann-Greiting Co.	..	....	1	620
Pusey & Jones Co.	6	1,684	..	....
Chester Shipbuilding Co.	7	34,000	..	....
Chicago Shipbuilding Co.	1	2,100	..	....
Toledo Shipbuilding Co.	7	17,900	..	....
United Engineering Works	1	3,500	..	....
Herreshoff Manufacturing Co.	1	178	..	....
Quintard Iron Works	1	900	..	....
Merrill-Stevens Co.	..	....	1	170
Milwaukee Bridge Co.	1	†....	1	†....
Cowles Shipyard†	1	20	..	....
James Rees & Sons Co.	1	†....	..	....
Tamps Foundry & Machine Co.	1	2,000	..	....
Total	230	*901,371	68	*176,319

*Incomplete. †Not reported.

Of the total number of vessels under construction no less than 122 are over 3000 tons each. Of these 16 are 3000 to 4000 tons; 10 are 4000 to 5000 tons; 47 are 5000 to 7000 tons; 33 are 7000 to 10,000 tons and 16 are 100,000 tons or over.

The contracts now held by American shipyards will serve to keep them busy throughout 1916 and a part of 1917 and a few vessels now being laid down will not be completed until 1918. The facilities of the principal yards are now so completely mortgaged for a year or more to come that contracts for vessels of special types are being declined although engagements are being made for the building of additional vessels of standard types for which new plans do not have to be drawn.

According to reports which are understood to represent conditions about Jan. 1, 1916, British shipyards have under construction vessels aggregating 1,506,925 gross tons. The yards of Denmark are said to be fully employed for two or three years. In France the yards are almost wholly engaged in naval work. The Netherlands plants are filled with orders up to 1917-18. Japan is busy with naval and merchant work, while in Norway the yards are full and owners are seeking to place orders in the United States.

The naval committees of Congress have been giving serious consideration to the question of the practicability of building, in accordance with the construction plans of the new national defense program, the large number of warships of various types recommended by the Navy Department. Rear Admiral David J. Taylor, chief of the Bureau of Construction and Repair, after a careful canvass of the situation, has forwarded to the House Naval Committee a statement to the effect that the new building program can be completed according to schedule if Congress will appropriate sufficient money to enable the Government to compete with private vessel owners, who are offering bonuses to many shipyards for early delivery. The only additional obstacle is a possible shortage of skilled workmen for whom there is an abnormal demand both in the shipbuilding industry and in the metal trades. Admiral Taylor states that there are ten building slips in private yards which are capable of taking the largest war vessels and of these four are specially equipped for the construction of battle cruisers. At reasonable expense there could be added six slips for capital ships. No concern is felt regarding the smaller vessels contemplated in the building program, and a single concern has agreed to furnish, if actually necessary, submarines for both coast and fleet service at the rate of 120 a year.

Admiral Taylor's report gives the impression that the great delay in beginning the construction of battleships Nos. 43 and 44 is the anxiety of Secretary Daniels to have them built in navy yards. This will probably result in postponing the completion of these important vessels for many months. W. L. C.

New Wisconsin Boiler Code

The Industrial Commission of Wisconsin has just issued the new Wisconsin boiler code to govern all steam boilers except those regularly inspected by the Federal Government, steam fire engines, those used exclusively for agricultural purposes, all of less than 10 hp., and those on which pressure does not exceed 15 lb. The code follows the requirements of the National Association of Stationary Engineers and was recommended by a special committee consisting of Theodore O. Vilter, Milwaukee; H. F. Bowie, inspector, Hartford Steam Boiler Inspection & Insurance Company; W. D. Johnson, secretary, Milwaukee Boiler Company, Milwaukee; R. Kunz, chief examiner, Milwaukee board of stationary engineers' examiners, and H. E. Pressinger, deputy Industrial Commission of Wisconsin.

To Make Basic Pig Iron

The Woodward Iron Company, Birmingham, Ala., will blow in a 400-ton furnace on basic pig iron July 1, and this furnace will run on basic continuously until Jan. 1 next, and perhaps for an indefinite period. The company has recently sold between 40,000 and 50,000 tons of pig iron and has inquiries for 75,000 tons.

The Carpenter Steel Company, Reading, Pa., has proposals out for a steel-frame mill building, 70 x 400 ft., to be added to its plant at Riverside. The plans, which have been drawn by Muhlenberg Brothers, Reading, will include a 20-in. 3-high rolling mill, driven by a 650-hp. motor. Crane equipment includes one 25-ton for the mill, one 10-ton for the annealing department, and two 5-ton for the heat-treating department.

The Texas Structural Steel Company, Dallas, Texas, has been organized. J. H. Brillhart is among those interested.

BRITISH STEEL EXPORTS LARGE

January Exceeds the Average for 1915—Pig Iron Exports Expanding

Despite the embargoes on certain iron and steel exports the British statistics for January show that 292,203 gross tons, excluding iron ore and including scrap, was exported in that month, as compared with 259,782 tons in December, 1915, and 230,204 tons in January, 1915. The January exports were considerably in excess of the average of 270,858 tons per month in 1915 and compare favorably with the monthly rate in 1913—331,029 tons. The highest exports for any war month were 351,984 tons in July, 1915.

Pig-iron exports were 70,313 tons against 17,345 in January, 1915, and 62,174 tons in December, 1915. The monthly exports in 1915 were only 42,378 tons and 55,748 tons in 1914 showing the present rate to be large despite embargoes and high prices. France took 44,027 tons and Italy 14,543 tons of the January exports.

Steel-bar exports continue very large, having been 58,741 tons against 30,226 tons in January, 1915, and 36,038 tons in December, 1915. The monthly averages in 1915 and 1913 were 40,788 tons and 20,921 tons, respectively. France took 49,845 tons of the January exports.

January feromanganese exports were about 7900 tons. In December they were 12,500 tons and the monthly export rate was about 8500 tons in 1915. Rail shipments were only 3151 tons against 24,411 tons in January, 1915, and a monthly rate of 20,190 tons in 1915—41,676 tons in 1913. Galvanized sheets amounted to 15,785 tons, while 23,870 tons was the monthly average in 1915 and 47,165 tons in 1914. Exports of tin plates and sheets in January were 26,271 tons; the monthly average in 1915 was 30,717 tons.

British imports of iron and steel in January, excluding ore and including scrap, were 81,248 gross tons. The average imports in 1915 were 107,944 tons per month and in 1913 they were 195,264 tons per month. January imports of blooms, billets and sheet bars were 12,253 tons. The monthly average in 1915 was 35,666 tons.

Iron-ore imports in January were 526,269 tons, as compared with 365,812 tons in January, 1915, and 593,247 tons in December, 1915. The January imports were in excess of the monthly average for 1915 which was 516,930 tons. In 1913 they averaged 620,187 tons per month.

Falling Off in British Rail Exports

Rail exports from Great Britain in 1915 were the lowest recorded in the past 10 years, being 242,289 gross tons against 433,507 tons in 1914 and 500,117 tons in 1913. The record in the 10 years was 580,215 tons in 1909; the low year outside of 1915 being 1911, when shipments were 375,296 tons. The total rail exports in 1906-1915, were 4,414,545 tons. Exports of rails from the United States in 1915 were 391,491 gross tons or more than 50 per cent greater than those of Great Britain.

The following manufacturers have advised that they are prepared to supply valves built to meet the requirements of the American Society of Mechanical Engineers' boiler code: American Steam Gauge & Valve Mfg. Company, Boston; the Ashton Valve Company, Boston; the Consolidated Safety Valve Company, New York; Crane Company, Chicago; Crosby Steam Gage & Valve Company, Boston, and the Lunkenheimer Company, Cincinnati.

The Lackawanna Iron & Steel Company, Lebanon, Pa., has placed a second order for nine 4-in. Birkholtz-Terbeck coke-oven gas burners, and the Ford Motor Company, Detroit, Mich., which has been experimenting with this burner for producer gas, has placed a repeat order.

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POLITICS IN TARIFF COMMISSION

Business Men Need to Move Promptly to Save the Situation

WASHINGTON, D. C., Feb. 29, 1916.—The reported disagreement between the Congressional leaders and the President as to the method of appointing the members of the proposed tariff commission reflects a situation here that calls for prompt and vigorous action by the business men of the country, who seem to be a unit for the proposition to "take the tariff out of politics."

President Wilson, though a recent convert to the commission idea, is determined that the five members of this important body provided for by the pending bill, shall combine as far as possible three important qualifications: first, they shall be non-partisan; second, they shall be familiar through experience or training with tariff problems, and third, they shall be men of such high character as to command the confidence of the business community.

The Congressional leaders, on the other hand, are planning to create a bi-partisan commission, to be composed of two low tariff champions, to be selected by the Democratic organization in Congress, two protectionists, to be chosen by the Republican organization (these four to be designated by the presiding officers of House and Senate), and a fifth member, presumably favorable to low tariff rates, to be picked by the President. Such a board would stand three to two for a low tariff during the present Administration but, presumably, upon the return of the Republican party to power at any time, the first vacancy among the free traders on the commission would be filled by the appointment of a protectionist and the balance of power would swing back to a high tariff.

It requires no imagination to foreshadow the kind of appointments that would be designated by the political organizations in Congress. There are, at all times, hanging about the Capitol numbers of former Senators and Representatives who have been retired to private life by the whirligig of politics and known variously as "lame ducks," "statesmen out of a job," etc. Through the good will of former associates, who are still in Congress, many of these ex-legislators find comfortable berths on the numerous commissions created by the Senate and House each year, some of them frankly for no more useful purpose than to supply jobs for political unfortunates. Of course, some of these retired Senators and Representatives are men of considerable ability, but their appointment to these commissions is in accordance with the principle that the man should seek the office rather than that the office should seek the man.

The demand of the Congressional leaders that they shall be permitted to name four of the five members of the commission demonstrates graphically their misconception of the functions of the commission as planned by the business men of the country and indorsed by President Wilson. The duty of the commission will be to collect in the most impartial manner the most reliable information obtainable regarding the industries of the United States and those of foreign countries that relates to the tariff problem. It will be no concern of the commission whether this information is to be utilized in the drafting of a protective tariff or a tariff "reform" law; facts are to be collated without bias and the task of making the final deductions therefrom is to rest with Congress. Under the Congressional plan the work of the commission would be in the hands of the three members sympathizing with the policy of the party in power, while the two members opposing that policy would be without duties or responsibilities and would constitute merely an element of discord in the membership of the body.

It is inconceivable that even a fraction of the business men of the country will align themselves with Congress on this issue. Rather, it goes without saying, that to a man they will support the President. To be effective, however, this support must be active rather than passive. Congress must be made acquainted with the attitude of the country on this question and this can only be done through the medium of frank and vigorous communications to Senators and Representatives. No time is to be lost if an effective demonstration is to be made, for the Ways and Means Committee is now at work upon the tariff commission provision of the general revenue bill soon to be reported.

Already gossip is busy with the names of prominent men whom the President may appoint to the commission. Leading the list just now is Secretary of Commerce William C. Redfield, who is reported to have been tentatively chosen by the President as the chairman of the commission. Dr. Edward E. Pratt, Chief of the Bureau of Foreign and Domestic Commerce, is also being discussed. Prominently mentioned is F. M. Halstead, chief of the Customs Division of the Treasury Department, an expert in tariff and customs law, who has held office under both Republican and Democratic administrations. Among well-known business men whose names are being canvassed is Howard H. Gross of Chicago, president of the Tariff Commission League, which has been so active in developing public sentiment in favor of the commission. W. L. C.

Bolivian Tin Smelting Project

The South American Electric Smelting Company has been organized to take over the equipment of the Standard Smelting Company, Pittsburgh, organized about a year ago for the smelting in this country of low grade tin bearing metal and latterly Bolivian tin concentrates. The plant at Pittsburgh was located in the building formerly occupied by the R. D. Nuttall Company, a Westinghouse interest.

The owners of the patents of the Wile Electric Furnace Company, Pittsburgh, have agreed to place a furnace in Bolivia and have it in operation within eight months from last November, in order to kill certain legislation that had been introduced for the exclusive smelting and waterpower rights for twenty-five years, and it was to carry out this obligation that the new company was formed and the operations of the old company stopped. It is proposed to put in three furnaces, each of 10 tons daily capacity, to take care of the tonnage guaranteed by certain interests at this time. As the business increases, additional furnaces will be installed. These will not all be put in one place on account of the difficulty in shipping ores to one spot. The initial furnaces will probably go forward by March 18, and it is expected that the three furnaces will be in operation by June 1.

Minor C. Keith of the United Fruit Company is president of the South American Electric Smelting Company and H. M. Keith is treasurer.

From the operations carried on in this country it was learned that the tin from the electric furnace, probably due to its high temperature, had a higher purity than that obtained from the reverberatory furnace. R. S. Wile, president Wile Electric Furnace Company, expects to leave soon for South America, to superintend the building of the new furnaces.

Jobbers and retailers in mechanics' tools and instruments are complaining of the ever-increasing shortage of supplies in the face of a constantly growing demand. In some instances orders filed in November and December have been only partly filled and deliveries on new orders are most uncertain. There is an extraordinary demand for micrometers and other of the more expensive tools, which are especially hard to get. It is also notable that prices have advanced all along the line, the factories explaining that the increased cost of raw materials and labor have made it necessary to advance the lists materially.

The Winchester Repeating Arms Company, New Haven, Conn., has sold $16,000,000 of two-year notes. It is officially announced that the proceeds will be used to take up an existing recent loan of $8,250,000 to pay the expenditures for plant extension, for the purchase of the raw materials required by the present large contracts, and to meet the increase in the company's payroll which now is about $1,500,000 a month.

FOUNDRY EXHIBITION PLANS

C. E. Hoyt Selected as Manager—A Joint Committee in Charge

C. E. Hoyt of Chicago, formerly secretary of the Foundry & Machine Exhibition Company, has been appointed manager of the exhibit of foundry equipment and supplies, which will be conducted under the auspices of the American Foundrymen's Association and the American Institute of Metals at the conventions of these two organizations at Cleveland, during the week of Sept. 11. Mr. Hoyt, as foundrymen well know, had an active part in the conduct of the foundry equipment shows at Cincinnati, Detroit, Pittsburgh, Buffalo and Chicago.

The Cleveland exhibition is in charge of a committee of eight, composed of representatives of the American Foundrymen's Association and the exhibitors. This committee is constituted as follows: R. A. Bull, chairman, president American Foundrymen's Association, Commonwealth Steel Company, Granite City, Ill.; Major Jos. T. Speer, past president American Foundrymen's Association, Pittsburgh Valve, Foundry & Construction Company, Pittsburgh; Alfred E. Howell, past president American Foundrymen's Association, Phillips & Buttorff Mfg. Company, Nashville, Tenn.; J. P. Pero, senior vice-president American Foundrymen's Association, Missouri Malleable Iron Company, East St. Louis, Ill.; A. O. Backert, secretary American Foundrymen's Association, Cleveland; S. T. Johnston, S Obermayer Company, Chicago; V. E. Minich, Sand Mixing Machine Company, New York, and H. S. Covey, Cleveland Pneumatic Tool Company, Cleveland.

The exhibition will be held at the Cleveland Coliseum, which has an available floor area on one level of 60,000 sq. ft. It is located within one block of the Hotel Statler, where the meetings of the American Foundrymen's Association and the American Institute of Metals will be held. It has been decided to charge the same prices for floor space as have prevailed heretofore. No floor plan of the building has yet been prepared, but a large number of applications for space have been received, and the indications are that the Coliseum will be inadequate and that the erection of a temporary building on an adjoining lot will be necessary.

At a recent meeting of the executive board of the American Foundrymen's Association it was decided to incorporate, and this will be done in the near future.

Foundry Conditions at Chester, Pa.

Steel foundries in the Chester, Pa., district are operating to full capacity on locomotive, ship, machine tool and miscellaneous castings, many plants being booked well ahead. The labor situation is annoying as to scarcity as well as demands, common laborers getting at least $1.80 to $2 per day. Molders are enjoying prosperity, the most unskilled getting $3.75 to $4 per day, and some command double these figures. The Chester Steel Castings Company, a large open-hearth foundry, which has been idle over three years, has started its furnaces and has substantial orders ahead. The new plant of the Atlantic Steel Castings Company has been operating its 5-ton oil-burning open-hearth furnace over three months with unusual success. The American Steel Foundries is making not less than one heat per day of vanadium steel for locomotive frames, some of these being unusually large. The Penn Steel Castings & Machine Company had the largest month in its history recently, when it shipped 2000 tons of finished castings.

The manganese question is a serious one for some plants. While one or two have a supply for a number of months ahead, others are uncertain as to the future. Experiments are being made at one plant to determine to what extent spiegeleisen can safely replace ferromanganese, and trials of 60 per cent or more of spiegel in place of ferromanganese are being made. Some success attends the substitution in case the proportion is not so large as to require the reduction of the carbon to too low a point before tapping. The average carbon content of steel castings in this district is 0.25 to 0.30 per cent with the manganese 0.60 to 0.70 per cent.

It is stated that sulphur is causing some difficulty, in that the low phosphorus pig iron used is averaging higher in sulphur than formerly, due to unusual pressure of production at the blast furnaces.

Important New Construction at Steelton and Sparrows Point

President E. G. Grace of the Bethlehem Steel Corporation and a number of officers of the Bethlehem Steel Company and the Pennsylvania Steel Company made an inspection tour last week of the plants of the latter company at Steelton, Pa., and those of the Maryland Steel Company at Sparrows Point, Md. In connection with the Steelton trip Mr. Grace stated that the blast furnace and power departments would be the first considered in the plans for improvements. He indicated that probably four additional blast furnaces would be built of a type similar to the recently completed No. 5 furnace at Steelton. The building of these furnaces is considered a most pressing need at Steelton and will be taken up at once. The complete overhauling of the power plant at Steelton will come later.

While at the Sparrows Point works of the Maryland Steel Company, Mr. Grace said that some of the extensions which had been planned for South Bethlehem would be made at Sparrows Point, probably having in mind the additional building of bar, tin plate and ultimately wire mills to turn out Bessemer steel products. The work of reclaiming additional land at Sparrows Point will be undertaken at once and it was stated that ultimately 5000 more men will be employed there. This will require the building of additional homes and the cost of the latter was put at $500,000. Sparrows Point will naturally be the largest shipbuilding operation of the Bethlehem Steel Corporation. The shipyard there now has contracts for twelve vessels. The estimate of the extensions and improvements at Sparrows Point which will eventually be put through by the new owners runs well above $10,000,000.

The announcement was made at South Bethlehem last week that the main office building of the Bethlehem Steel Company would be extended by the erection of a three-story structure containing forty-five rooms. It will be built so that three stories can be added.

To Make Ferromanganese at Chicago

Under a conversion contract the Miami Products Company, 122 South Michigan Avenue, Chicago, has taken over the A furnace of the Iroquois Iron Company at South Chicago and will manufacture ferromanganese and spiegeleisen. This stack, which is the first and smallest of the four Iroquois furnaces, has been idle since February, 1911. In preparation for renewed activity, a considerable repairing of the furnace will be undertaken and a Brassert-Bacon gas washer installed. Domestic ores are to be used. The product of the furnace will be sold by Rogers, Brown & Co., but the tonnage to be made is as yet uncertain. The Miami Products Company has been organized with a capital of $100,000 by Chester D. Tripp, Francis H. Hardy and Harry W. Lippencott.

The fifth annual exposition of flour mill machinery will be held in St. Louis, Mo., in connection with the thirteenth annual convention of the Fraternity of Operative Millers of America May 29 to June 2. The exposition will be located in the Coliseum, the largest auditorium in the city, in which the Democratic national convention is to be held later in June. The officers of the local organization are as follows: William Essmueller, president; F. E. Eichler, treasurer, and John Cornelius, secretary, all of St. Louis. The national president is E. T. Bauer, Wichita, Kan., and J. A. Wells is secretary.

SERIOUS FREIGHT SITUATION

Shut-downs May Come from Latest New England Embargo

While New England manufacturers have been having trouble for many weeks in getting east-bound freight, the recent embargoes have made a bad condition worse. The New Haven lines on Feb. 28 renewed the embargo which was partly lifted about three weeks ago and the new order is even more stringent in its terms. The New York Central lines have an embargo in force against the Boston & Maine, dating from Feb. 12, and another against the Boston & Albany, issued Feb. 22.

The latest New Haven order permits only the acceptance from connecting roads of live stock, perishable foodstuffs for human consumption, feed for live stock, news print paper for domestic use only, charcoal and fuel oil and gasoline in tank cars. A further notice expressly places an embargo against shipments of spelter, copper, pig lead, iron or steel construction material, cement, wall plaster, stone, lime, brick, lumber, terra cotta and tile from New York City, Brooklyn terminals, and New York lighterage points, or from water craft at Long Island Sound ports and Boston. An embargo is also placed against all freight for lighterage delivery in New York Harbor and against all shipments to the Merchants' & Miners' Transportation Company at Boston and Providence.

It is beyond question that this embargo will create a desperate situation for many manufacturers in southern New England. Few of the plants have been able to store up material in their reserves on the limited amounts which they have been able to secure during the past weeks of freight congestion. As soon as notice was issued Monday that this strict embargo would go into force at midnight there was a rush of traffic men for the producing centers. One man, representing a large plant in central Massachusetts, was on his way to Baltimore to rescue freight consigned to some of the southern New England ports and was planning to re-route it through Buffalo and Canada, coming down into New England from the north. Unless this move was promptly successful it meant the shutting down of a plant employing several hundred hands. This condition is only typical of that in which many large factories are placed by reason of the freight congestion.

The railroads are putting forth every effort to keep the factories running and most manufacturers appreciate the conditions which prevail in this abnormal period. It is reported that on the New Haven lines there are 55,000 cars scattered over practically all available sidings of the system. The road can handle about 45,000 cars with its present equipment. It now appears that the placing and lifting of embargoes for alternating periods of a few days or weeks will continue to be a feature of the difficulties which face New England manufacturers.

Louisville Mill to Be Reopened

Plans for the organization at Louisville, Ky., of the Louisville Steel & Iron Products Company, incorporated under the laws of Arizona with $1,125,000 capital, are announced. It will take over the old plant of the Louisville Bolt & Iron Company in South Louisville. Arrangements to purchase the plant have been completed, it is stated. O. C. Carter, Chicago, formerly general freight agent of the Monon Railroad, has been chosen president, and R. A. McDowell, Louisville, will be vice-president and general counsel, with George H. Holzbog, Jeffersonville, Ind., secretary and treasurer. The products contemplated are sheet iron and steel and bar iron and steel. The plant has not been operated for six years, although the machinery and equipment are said to have been kept in good condition.

Corrigan, McKinney & Co., Cleveland, Ohio, started the blooming mill of their new steel plant in operation Feb. 28. Six of their open-hearth furnaces have been in operation for several weeks. The sheet-bar and billet mill will be started up shortly.

Baltimore's New Tin-Plate Plant

The Baltimore Sheet & Tin Plate Company has placed contracts for machinery and material and expects to have its plant in operation by November. It will have 12 hot and 12 cold mills, all electrically driven, and its output is put at a rate of 1,000,000 base boxes per year. Plans for the future are that black and blue annealed sheets will be added. The heavy consumption of tin plate in Baltimore, the location for water transportation of products for general export and for the Pacific coast through the Panama Canal, and the availability of electric power transmitted some 60 miles from the Susquehanna River were factors in the launching of the project.

J. M. Jones, who retired Feb. 29 as vice-president and general manager of the Massillon Rolling Mill Company, Massillon, Ohio, is president. Charles E. F. Clarke, president and treasurer of the Pennsylvania Water & Power Company, which is the company supplying, largely through the Consolidated Gas, Electric Light & Power Company, the power taken by the numerous industries which have been developed in Baltimore, is vice-president. The other directors are J. E. Aldred, chairman of the board of both the Consolidated and Pennsylvania companies named; Charles M. Cohn, vice-president of the Consolidated; Howard Bruce, president Bartlett-Hayward Company; John M. Dennis, president Union Trust Company, Baltimore, and, incidentally, State Treasurer of Maryland; John R. Bland, president United States Fidelity & Guarantee Company, Baltimore, and R. C. Hoffman, Jr., and J. J. Hock, both identified with the iron and steel business. John L. Bailey, treasurer Consolidated Gas, Electric Light & Power Company, is secretary and treasurer.

The property acquired covers 12 acres, and a contract for the steel buildings, involving 1500 to 1800 tons, has been placed with the Riter-Conley Mfg. Company. A capital stock of $5,000,000 has been authorized, and 60 per cent issued, half 7 per cent cumulative preferred stock and half common stock. Common and preferred stock have equal voting power and the preferred is convertible into common stock at par or redeemable at 115 per cent. Dividends on preferred stock will be cumulative from Oct. 2, 1916. With three shifts of employees per day, it is expected that 600 in all will be employed and between 3000 and 3500 hp. will cover the power requirements.

Iron-Ore Sintering Patents

Arthur S. Dwight of New York has recently been granted two patents covering processes for sintering iron ores. The first, granted Jan. 25, 1916, relates to the treatment of ore bodies which can be sintered or agglomerated by combustion within the mass or by external heat to form sinter cakes or blocks which are porous, more particularly as to the preliminary treating of these cakes to prepare them for smelting or other subsequent treatment. The second patent, also dated Jan. 25, 1916, covers improvements in the apparatus for treating ores which are susceptible of a desulphurizing or similar treatment and a sintering treatment, either simultaneously or successively. The apparatus is also adapted to the treatment of iron or other ores in which there is normally no combustible matter present.

The Cleveland Motor Plow Company, which was recently formed to manufacture on a large scale motor-driven plows, has completed its organization by the election of Rollin H. White, president; C. A. Hawkins, vice-president and general manager; C. G. White, vice-president. E. H. Ruck is factory manager. The company is located at 847 Leader-News Building, Cleveland, Ohio, where it will maintain offices until about May 1, when its new plant will be completed.

Ten forge fires at the Valley plant of the Worth Brothers Company, Coatesville, Pa., which were lighted last December after having been idle for two years, have been put on double turn. This will enable enlarged operations of skelp mills at both the Valley and the Viaduct plants.

New England Labor Troubles

Loop molders and coremakers, numbering over 100, in the North Side plant of the H. B. Smith Company, Westfield, Mass., have gone on strike because of dissatisfaction with a recent increase in pay. The unskilled laborers in the plant have gone out on a sympathetic strike.

The American Brass Company on Feb. 24 posted in all its factories in the Naugatuck Valley this notice: "In addition to the raise of wages fixed as per notice effective Feb. 14, a further advance of 5 per cent effective Monday, Feb. 21, will be made in the pay of all employees working on an hourly rate or on piece work, including both day and night shifts. This increase of 5 per cent will be figured on top of the increase of 10 per cent effective Feb. 14." At a conference Feb. 26, the strikers in the Ansonia plants decided to return to work and the shops reopened Feb. 28.

After a conference with the management on Feb. 23, the striking drop forgers at the Remington Arms & Ammunition Company, Bridgeport, Conn., voted to return to work. The terms of settlement have not been announced.

The strike at the Randolph-Clowes Company, Waterbury, Conn., was settled Feb. 22, on the basis of a 59-hr. week with 60-hr. pay, all unsalaried employees to receive an increase of two and one-half cents per hour and time and a half for overtime.

The Scovill Mfg. Company, Waterbury, Conn., has announced a 10-per cent bonus on wages earned from Jan. 1 to Jan. 28. The company had previously given several 5-per cent bonuses.

The Star Pin Company, Shelton, Conn., on Feb. 24 gave its 500 employees a bonus of 10 per cent of their 1915 wages.

As a result of conferences between a committee of the Iron Molders' Union and a committee of manufacturers, there will become effective about April 1 a general increase of wages to the iron molders of Springfield, West Springfield, Indian Orchard and Chicopee, Mass. The present minimum is $3.25 a day. The new minimum scale will be $3.60. Between 400 and 500 employees will be affected by the new scale.

Safety Organization in the Steel Industry

At the fourth convention of the National Safety Council held in Philadelphia in October, 1915, the executive committee decided that the conventions were becoming too large to be controlled at single meetings, and it was therefore decided to divide the meetings into sections, such as iron and steel, laundry, textile, etc. A chairman of the iron and steel section was elected and he appointed his executive committee. A meeting of this executive committee was held in Chicago, in January, and a second meeting was held in Washington, D. C., Feb. 21. A letter was sent out to about 350 prospective members by the membership committee, and it has brought very good results.

The bulletin committee is now at work on bulletins for distribution to iron and steel manufacturers. The program committee will submit a tentative program at the next meeting of the executive committee. A second letter is being drafted by the membership committee to be sent out to the iron and steel concerns not already in the council. In October, when the National Council holds its convention in Detroit, each section will have its own meetings.

The iron and steel executive committee is made up as follows: J. M. Woltz, safety director, Youngstown Sheet & Tube Company, Youngstown, Ohio, chairman; G. T. Fonda, safety engineer, Bethlehem Steel Company, South Bethlehem, Pa., vice-chairman; E. M. Peake, chief of safety department, Carnegie Steel Company, Pittsburgh, chairman of membership and publicity committee; J. C. Smith, safety inspector, Inland Steel Company, Indiana Harbor, Ind., chairman of committee on accidents, their causes and remedies; R. J. Young, manager department of safety and relief, Illinois Steel Company, Chicago, chairman of standardization committee, and E. R. Rose, secretary, central safety committee, Republic Iron & Steel Company, Youngstown, Ohio, chairman of program committee.

Pig Iron Production in 1915 Was 29,916,213 Tons

Statistics of the production of pig iron in the United States in 1915 are given in a bulletin issued by the American Iron and Steel Institute, 61 Broadway, New York, under date of Feb. 26. The output is shown to have been 29,916,213 gross tons, of which 296,152 tons was charcoal pig iron. The production of basic pig iron was 13,093,214 tons and of Bessemer pig iron 10,523,306 tons.

A statement of production by grades and the percentage of each is given in the following table, with corresponding figures for 1914. It will be seen that the production of ferromanganese and spiegeleisen were both somewhat larger in 1915 than in 1914. This increase, according to present indictions, will be carried considerably farther in 1916:

	1915	Per Cent	1914	Per Cent	Increase	Per Cent
Basic	13,093,214	43.77	9,670,687	41.45	3,422,527	35.39
Bess.	10,523,306	35.17	7,859,127	33.68	2,664,179	33.90
Fdy.	4,864,348	16.26	4,533,254	19.43	331,094	7.30
Mall.	829,921	2.77	671,771	2.88	158,150	23.54
Forge	316,214	1.06	361,651	1.55	45,437*	12.56*
Spiegel.	97,885	0.33	79,935	0.34	17,950	22.46
Ferro	129,072	0.43	106,083	0.46	22,989	21.67
All other	62,253	0.21	49,736	0.21	12,517	25.17
Total	29,916,213	100.00	23,332,244	100.00	6,583,969	28.22

*Decrease.

The total production of pig iron in the first half of 1915 was 12,233,791 tons and in the second half 17,682,422 tons. Thus the second half output was nearly 45 per cent greater than that of the first half. The output of basic pig iron in the second half was 7,833,600 tons, against 5,259,614 tons in the first half, representing an increase of a fraction under 50 per cent.

Locomotive Buying Still Large

Orders for 133 locomotives have been placed in the past week with further inquiries for about 75. The American Locomotive Company will build 55 for the New York Central and it is stated that the purchase of 250 more is contemplated; this road ordered 95 from the Lima Locomotive Corporation two weeks ago. The Illinois Central will obtain 20 Pacific type locomotives from the American Locomotive Company and the Lehigh Valley 20 Mikado and the Bessemer and Lake Erie 20 Santa Fe type from the Baldwin Locomotive Works. The Baltimore & Ohio has placed inquiries for 50 Mikado and 15 switching locomotives and the Chicago & Northwestern is expected to buy a large number. Estimates place the total locomotives ordered up to Feb. 26 of this year at 641, of which 139 are foreign. Present buying is far ahead of last year's rate when only 1972 were bought.

The Bytanic Metal Company, Boatmen's Bank Building, St. Louis, Mo., has purchased the partly dismantled plant of the St. Louis Steam Forge Works in East St. Louis, Ill., and will rehabilitate and remodel it to manufacture commercial forgings and steam and electric railroad axles. The four steam hammers of the plant will be completely overhauled, new furnaces will be installed and other equipment added. W. S. Bremer is president; L. B. Tebbetts, 2d, secretary-treasurer; W. L. Allen, a metallurgical expert of Pittsburgh, general manager. A capacity of about 25,000 tons of forgings per year is planned at present, with future enlargement.

The Hoyt Metal Company, St. Louis, Mo., manufacturer of non-ferrous metals and metal alloys, has prepared plans for the equipment of a welfare building which it will erect at its large plant in Granite City, Ill. The company, which started as a partnership in 1876 making babbitt metal in a small way, is now reputed to be the largest concern of its kind in the world, operating, in addition to its factory at Granite City, plants at Perth Amboy, N. J., Toronto, Canada, and London, England.

Iron and Steel Markets

AN EXCITED MARKET

Price Advances in a Long List of Products

Heavy Sales of Pig Iron and Steel Scrap—Railroad and Shipyard Buying for 1917

Steel prices are rushing up at a furious pace and in the past week conditions have grown more excited. Manufacturers as well as buyers consider the present level dangerous, but some of them had the same view weeks ago. Now they generally protest that they are creatures of a situation the end of which none can predict.

It has been a week of heavy buying in many quarters, notably in pig iron and old material. More than 200,000 tons of steel-making pig iron has been closed and the Steel Corporation alone has bought 100,000 tons of steel scrap in the Pittsburgh and Chicago districts.

It would be easier to name products which have not been advanced in the week than those which have been pushed up under buying in many cases more urgent than has yet been seen. At Pittsburgh Bessemer iron is 50c. to 75c. higher; basic iron, 25c. to 50c.; heavy steel scrap, 75c.; skelp, $2; light rails, $3; wire products, $2; black pipe, $2; galvanized pipe, $4; boiler tubes, $2; refined iron bars, $2; sheets, $3 to $5; cold rolled strip steel, $5 to $10; merchant steel, $3 to $4; shafting, $5; spikes, $2 to $3.

No end is in sight to the advances and the volume of orders ahead of the mills is growing faster. Many buyers are afraid to contract at these prices, but most of them seem more afraid of being without material in the latter part of the year than of paying any price producers may name.

Railroads see that $30 open-hearth rails are the cheapest product on the list and at least three systems have placed orders as far ahead as 1917, the total thus far for that delivery being about 70,000 tons.

Shipyard buying is at a pace never before known, and already the leading steel interest has booked 110,000 tons of steel for twenty vessels that will be under construction in the second quarter of 1917, largely for foreign owners. On these contracts the basis was 2.50c., Pittsburgh, for plates, 2.35c. for shapes and 2.30c. for bars.

Similarly there is figuring long ahead for steel for bridges and buildings. The American Bridge Company has taken the contract for a bridge for the Bessemer & Lake Erie Railroad over the Allegheny River at Oakmont, Pa., that will require 10,000 to 12,000 tons and will be a year in building. A bridge at Steubenville, Ohio, for the LaBelle Iron Works will take 5000 tons. A bridge over the Ohio River at Louisville, Ky., just let, calls for 5000 tons. In the East fully 15,000 tons in structural contracts has been let this week and nearly as much is about to be closed. Quick decisions have been made on some work to avoid higher prices.

At the same time no week has brought out more cases of undertakings postponed on account of high prices and the unwillingness of mills to make definite promises of deliveries. A good many plans are being changed so that more concrete can be used in bridge and other work.

New rail orders include 33,000 tons for the Southern Railway, of which 30,000 tons go to Ensley; 5000 tons for the Wheeling & Lake Erie, 6500 tons for the B. & O. and 3200 tons for the C., H. & D. The Russian rail contracts went to three mills, and the total is about 60,000 tons. It is understood vessels have actually been bought to insure delivery of these rails.

Pittsburgh reports the offering of 100,000 tons of bars for shells, which mills have been unable to consider. Considerable foreign requirements have come up for large squares and blooms for forging. But efforts of foreign buyers have lately concentrated on barb wire for the second half, and 50,000 to 100,000 tons is before the mills. The wire situation, after repeated advances, the last one Feb. 29, bringing nails to $2.40, is tightening to a point indicating shortages in some lines.

Activity in steel-making pig iron, along with heavy buying of steel scrap, shows the larger steel companies' need of outside material. One Pittsburgh interest bought 35,000 tons of basic and 35,000 tons is under inquiry in that market. Cincinnati sales of basic amounted to 60,000 tons, and a large block is pending there. An Indiana steel company bought 20,000 tons, and in eastern Pennsylvania 12,000 tons was taken, while Buffalo reports a good-sized basic sale. The price has gone back to $18 at Valley furnace after the recent easing off, and sellers are asking $18.25 and higher. In eastern Pennsylvania a sale of 5000 tons was made at $19.50 at furnace.

The whole pig-iron market is more active and prices are higher, after some recent irregularities, particularly in foundry iron.

Chicago

CHICAGO, ILL., March 1, 1916—(*By Wire.*)

The prohibitive limit appears to have been closely approached in the new high level of prices, except for purchases of material such as are urgently required and can be had by prompt shipment. Projects of a kind to preclude the payment of the current abnormal prices, if satisfactory returns on the investment are to be had or whose present consideration is rendered futile because of indefinite delivery promises, are being halted in increasing number. New construction requiring shapes and plates is especially hard hit. Reports of specific instances, as well as the decrease in new business, point out the existence of this enforced deferment. The scramble for rolled steel and raw materials for immediate use is, on the other hand, continuously accentuated, and among finished products the scarcity of plates is most seriously felt. An inquiry for 2000 tons of plates last week brought out nothing but quotations at the premium price of 3c., Pittsburgh. A measure of relief is being found for the shortage of structural steel

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous

Pig Iron, Per Gross Ton:	Mar. 1, 1916.	Feb. 23, 1916.	Feb. 2, 1916.	Mar. 3, 1915.
No. 2 X, Philadelphia	$20.00	$20.00	$20.00	$14.25
No. 2, Valley furnace	**18.50**	18.25	18.50	13.00
No. 2 Southern, Cin'ti	17.90	17.90	17.90	12.40
No. 2, Birmingham, Ala.	15.00	15.00	15.00	9.50
No. 2, furnace, Chicago*	18.50	18.50	18.50	13.00
Basic, del'd, eastern Pa.	19.50	19.50	19.50	13.50
Basic, Valley furnace	**18.00**	17.75	17.75	12.50
Bessemer, Pittsburgh	**21.45**	20.70	21.45	14.55
Malleable Bess., Ch'go*	19.00	19.00	19.00	13.00
Gray forge, Pittsburgh	18.45	18.45	18.45	13.45
L. S. charcoal, Chicago	19.75	19.75	19.75	15.75
Billets, etc. Per Gross Ton:				
Bess. billets, Pittsburgh	**37.00**	35.00	33.00	19.50
O.-h. billets, Pittsburgh	**38.00**	35.00	34.00	19.50
O.-h. sheet bars, P'gh	**38.00**	35.00	35.00	20.50
Forging billets, base, P'gh.	55.00	55.00	55.00	24.00
O.-h. billets, Phila	42.00	42.00	42.00	21.52
Wire rods, Pittsburgh	50.00	50.00	45.00	25.00
Finished Iron and Steel, Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bess. rails, heavy, at mill	1.25	1.25	1.25	1.25
Iron bars, Philadelphia	**2.359**	2.409	2.409	1.15
Iron bars, Pittsburgh	**2.35**	2.25	2.15	1.10
Iron bars; Chicago	**2.00**	1.90	1.90	1.10
Steel bars, Pittsburgh	2.50	2.50	2.25	1.15
Steel bars, New York	2.669	2.669	2.419	1.319
Tank plates, Pittsburgh	2.75	2.75	2.50	1.10
Tank plates, New York	3.169	3.169	2.669	1.269
Beams, etc., Pittsburgh	2.25	2.25	2.00	1.15
Beams, etc., New York	2.419	2.419	2.119	1.319
Skelp, grooved steel, P'gh	**2.10**	2.00	1.90	1.10
Skelp, sheared steel, P'gh.	**2.20**	2.10	2.00	1.15
Steel hoops, Pittsburgh	2.50	2.50	2.10	1.25

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Sheets, Nails and Wire, Per Lb. to Large Buyers:	Mar. 1, 1916. Cents.	Feb. 23, 1916. Cents.	Feb. 2, 1916. Cents.	Mar. 3, 1915. Cents.
Sheets, black, No. 28, P'gh.	2.60	2.60	2.60	1.80
Galv. sheets, No. 28, P'gh.	4.75	4.75	4.75	3.40
Wire nails, Pittsburgh	**2.40**	2.30	2.20	1.60
Cut nails, Pittsburgh	**2.30**	2.20	2.10	1.55
Fence wire, base, P'gh	**2.25**	2.15	2.05	1.40
Barb wire, galv., P'gh	**3.25**	3.15	3.05	2.10
Old Material, Per Gross Ton:				
Iron rails, Chicago	17.25	17.25	17.50	12.00
Iron rails, Philadelphia	19.50	19.50	19.50	13.00
Carwheels, Chicago	13.50	13.50	14.25	10.00
Carwheels, Philadelphia	16.50	16.50	16.50	11.00
Heavy steel scrap, P'gh.	**17.75**	17.00	17.25	12.00
Heavy steel scrap, Phila.	16.50	16.50	16.50	10.50
Heavy steel scrap, Ch'go.	**15.75**	14.75	14.75	9.75
No. 1 cast, Pittsburgh	15.75	15.75	15.75	11.25
No. 1 cast, Philadelphia	17.00	17.00	17.00	12.00
No. 1 cast, Ch'go (net ton)	**13.25**	12.75	13.00	9.00
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt	$3.50	$3.50	$2.75	$1.50
Furnace coke, future	2.50	2.50	2.50	1.65
Foundry coke, prompt	**3.75**	3.50	3.50	2.00
Foundry coke, future	**3.50**	3.25	3.25	2.15
Metals, Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York	27.37½	27.37½	25.50	15.25
Electrolytic copper, N. Y.	*27.12½*	27.25	25.37½	14.62½
Spelter, St. Louis	*20.50*	21.25	18.25	10.35
Spelter, New York	*20.75*	21.50	18.50	10.50
Lead, St. Louis	**6.30**	6.22½	6.00	3.85
Lead, New York	6.30	6.30	6.10	3.90
Tin, New York	**48.00**	42.20	41.62½	40.75
Antimony, Asiatic, N. Y.	44.00	44.00	42.50	18.50
Tin plate, 100-lb. box, P'gh.	$4.00	$4.00	$3.75	$3.10

in the turning to reinforced concrete construction, and a considerable inquiry for reinforcing steel is noted. Quotations of 2.25c., Chicago, for high carbon bars are less oppressive in view of the smaller tonnage required as compared with structural shapes. Iron bars are relatively cheap at 2c., Chicago mill. A less than normal tonnage of black sheets is available as the result of the diverting of more capacity by a number of sheet mills to the more profitable rolling of blue annealed. Store prices continue to move upward, and plates are now on the basis of 3.15c., Chicago, with bars and shapes 2.90c. The apathy of pig-iron melters with respect to their last half requirements has given way to a lively show of interest, and sales are rapidly increasing in number, supplementing the appearance of general inquiry last week. Following a purchase of heavy melting steel by an important local interest, and sales of over 10,000 tons of wrought scrap on the basis of $16, the scrap market has reacted sharply toward higher prices. Inquiry for used rolling-mill equipment, power plants and machinery is unprecedented.

Pig Iron.—A very general renewing of interest in pig iron for last half delivery has been bringing many inquiries into the market, and already the placing of a comparatively large number of orders has resulted. As contrasted with the period of quiet experienced in January and early February, the activity has some of the proportions of a buying movement. Inquiry is very largely for malleable and Northern foundry iron, and the trade appears to be interested in a way that will eventuate into a covering for a large part of last half requirements, although buying does not seem as yet to be fully under way. For the time being, Southern iron is, relatively speaking, neglected, a few sales only, of 300 to 1000 tons, being reported. The greater activity with respect to Northern irons is, however, hardly more than the price would suggest. Southern iron continues at $19, Chicago, for first half, and $19.50 for second half, while local furnaces are asking $18.50 and $19 respectively for foundry and malleable irons. In the way of higher prices, advances of $2 per ton on Ohio silveries and $3 on Bessemer ferrosilicon have been announced. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace, and do not include a switching charge averaging 50c. per ton:

Lake Superior charcoal, Nos. 2 to 5	$19.75
Lake Superior charcoal, No. 1	20.25
Lake Superior charcoal, No. 6 and Scotch	20.75
Northern coke foundry, No. 1	19.00
Northern coke foundry, No. 2	18.50
Northern coke foundry, No. 3	18.00
Southern coke, No. 1 f'dry and 1 soft	$19.50 to 20.00
Southern coke, No. 2 f'dry and 2 soft	19.00 to 19.50
Malleable Bessemer	19.00
Basic	18.50 to 19.00
Low phosphorus	34.00 to 36.00
Silvery, 8 per cent	29.50
Bessemer ferrosilicon, 10 per cent	33.50

(By Mail)

Rails and Track Supplies.—Further purchases of tie-plates, including an order for 300,000 from one of the railroads of the Northwest, are interesting because of the almost exclusive buying of iron plates occasioned by the higher prices and tardy deliveries quoted for steel tie-plates. The St. Louis & San Francisco is inquiring for 700,000. Some 20,000 tons of rails for fourth quarter were placed, including 6500 tons for the Baltimore & Ohio, 4000 tons for the Southern and 3200 tons for the Chicago, Hamilton & Dayton. Prices of spikes and track bolts have been again advanced, the former to a minimum of 2.60c., and the latter, by one maker at least, to 3.25c., Pittsburgh, and 3.50c., Chicago, although the largest Western mill is asking but 3c. Another advance of approximately $2 per ton in the prices of light rails is announced. We quote standard railroad spikes at 2.60c., base; track bolts with square nuts, 3c. to 3.50c., base, all in carload lots, Chicago; tie plates, $45, f.o.b. mill, net ton; standard section, Bessemer rails, Chicago, 1.25c., base; open hearth, 1.34c.; light rails, 25 to 45 lb., 1.61c.; 16 to 20 lb., 1.66c.; 12 lb., 1.71c.; 8 lb., 1.76c.; angle bars, 1.50c. to 1.75c., Chicago.

Structural Material.—The tonnage involved in new work for which contracts were placed with fabricators last week was small. Five contracts reported totaled only 845 tons. It is perhaps significant of what increasing evidence indicates that considerable work requiring structural material is being deferred, or being designed for reinforced concrete construction. A Western fabricator advises of three or four contracts aggregating 1400 tons, the placing of which has been indefinitely postponed. An Iowa fabri-

cator reports recent instructions that all State bridges shall be designed in reinforced concrete as far as possible. One of the largest jobs recently under consideration, involving possibly 6000 to 8000 tons, is to be postponed until the situation is more favorable. Notwithstanding, there is a very considerable inquiry where tonnages are of moderate size and where the additional present cost of steel can be absorbed in unusual profits. Car inquiry continues to run into large figures. We quote for Chicago delivery of structural steel from mill 2.439c.

This week brings another advance in the price of structural steel out of stock but without apparent effect on the volume of business offered to the jobber. Spring building construction of the kind involving only a few tons of steel to the job promises to be heavy, and buying for this purpose is already under way. We quote for Chicago delivery of structural steel from store 2.90c.

Plates.—The scarcity of plates is more pronounced with each week. The only kind of a quotation which an inquiry for 2000 tons of plates brought out this week was a prompt shipment quotation on the basis of 3c., Pittsburgh. Some work involved in blast-furnace improvements in this district is being seriously hampered because of inability to secure plates, especially in the larger sizes. We quote for Chicago delivery of plates from mill 2.539c., for contract shipments, and 3c. to 3.189c. for prompt shipment.

The store price for plates has been advanced $2 per ton, reducing to $5 the spread of $6 existing last week between shapes and plates. We quote for plates out of Chicago stock 3.15c.

Sheets.—A considerable variation in the price of one-pass box annealed sheets is reported as the result of the diverting of capacity by some of the sheet mills to the manufacture of blue annealed. As a result prices for black sheets range from 2.70c., Pittsburgh, on the box-annealed basis, to 3.20c., which conforms to prices obtaining for blue annealed. There is very little galvanized sheet tonnage available, some of the mills being definitely out of the market for the next 60 days. We quote for Chicago delivery from mill, No. 10 blue annealed, 2.939c.; No. 28 black, 2.889c.; No. 28 galvanized, 5c.

Following the advance of last week in the store price of other grades of sheets, the quotation for blue annealed has been advanced to 3.10c. and we quote for Chicago delivery from jobbers' stock, minimum prices applying on bundles of 25 or more, as follows: No 10 blue annealed, 3.10c.; No. 28 black, 3c. to 3.10c.; galvanized, 22 gage and lighter, on the basis of 5.15c.; 5.25c. for No. 28; 20 gage and heavier, on the basis of 4.80c. to 4.90c. for No. 28, the usual differentials obtaining.

Bars.—Even at a minimum of 2c., Chicago mill, bar iron is relatively cheap as compared with quotations in other markets and the prices of other materials, and in a limited way orders from distant territories are being placed here. Hard-steel bars have been advanced to 2.25c., and with the rapidly increasing demand for reinforcing steel, which is already appearing, higher quotations are promised. For mild-steel bars, prices equivalent to 2.50c. and 2.60c., Chicago mill, are being paid, the only tonnage available being that offered by mills catering to prompt shipment business. We quote mill shipments, Chicago, as follows: Bar iron, 2c.; soft steel bars, 2.439c. to 2.50c.; hard steel bars, 2.25c.; shafting, in carloads, 45 per cent off; less than carloads, 40 per cent off.

The price of bars out of store is again up $3 per ton and we quote store prices for Chicago delivery: Soft steel bars, 2.90c.; bar iron, 2.90c.; reinforcing bars, 2.90c., base, with 5c. extra for twisting in sizes ½ in. and over and usual card extras for smaller sizes; shafting 15 per cent off.

Rivets and Bolts.—The inquiry for bolts continues to be of considerable size, including an insistent demand in a number of instances for material for early shipment. Quotations on this inquiry are developing a high level of prices. Rivet prices in this market vary widely, although nominally the advance to the basis of 3c., Pittsburgh, is being followed. We quote as follows: Carriage bolts up to ⅝ x 6 in., rolled thread, 65-5; cut thread, 65; larger sizes, 50-15; machine bolts up to ⅝ x 4 in., rolled thread, with hot pressed square nuts, 65-10; cut thread, 65-5; larger sizes, 50-20; gimlet point coach screws, 65-10-5; hot pressed nuts, square, $3.70 off per 100 lb.; hexagon, $3.80 off. Structural rivets, ¾ to 1¼ in., 3c. to 3.15c., base, Chicago, in carload lots, boiler rivets, 10c. additional.

We quote prices, out of store: Structural rivets, 3.25c.; boiler rivets, 3.35c.; machine bolts up to ⅝ x 4 in., 70-12½; larger sizes, 65-10; carriage bolts up to ⅝ x 6 in., 70-5; larger sizes, 65 off; hot pressed nuts, square, $4.50, and hexagon, $4.70 off per 100 lb.; lag screws, 75.

Cast-Iron Pipe.—The amount of pipe business reflects the seasonable activity. At Mason City, Iowa, the leading interest is the low bidder for 600 tons, also for 1600 tons at Cincinnati and 700 tons at Bloomington, Ind. Of the 2600 tons to be bought at Los Angeles, 1600 tons will go to the American Cast Iron Pipe Company, 1000 tons remaining to be awarded. New lettings include 1800 tons at Columbus, Ohio, and 5500 tons at Detroit. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $32.50 to $33; 6 in. and larger, $29.50 to $30, with $1 extra for class A water pipe and gas pipe.

Wire Products.—In the consideration of new orders which manufacturers and jobbers are seeking to place, the leading mills are declining to commit themselves beyond the general promise to care for their customers at the price obtaining when the order is booked. That the upward trend of prices is still to be reckoned with is generally accepted. We quote to jobbers as follows: Plain wire, No. 9 and coarser, base, $2.339; wire nails, $2.489; painted barb wire, $2.639; galvanized barb wire, $3.339; polished staples, $2.639; galvanized staples, $3.339, all Chicago.

Old Material.—The scrap market, which has been drifting for a number of weeks, is again making headway in consequence of renewed buying of steel and rolling-mill grades. Purchases within the past two weeks have been sufficient, as to number and tonnage involved, to establish a market level more representative of free trading than were the quotations brought out by the carload sales of the preceding several weeks. Lower prices were doubtless brought out in connection with these small transactions than were reached at any time in connection with purchases of any volume. The filling of orders for Munhall, Pa., Gary, and Indiana Harbor reveals an apparent shortage of heavy melting steel, though shoveling steel is reasonably plentiful. Purchases of No. 1 wrought, busheling and cast scrap are reported at prices considerably higher than our last quotations. While the market established for No. 1 wrought appears to be $15.50, at least one transaction, in which 2500 tons changed hands, carried a price of $16. Brokers are now offering $15.50. Heavy melting steel has sold at $15.25 and $15.50, busheling at $12.25 and cast scrap at $13.25. Scrap offerings from the railroads are again small, the principal list for local sale being that of the Chicago & Northwestern, amounting to about 2000 tons. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton

Old iron rails	$17.25 to $17.75
Relaying rails	19.50 to 20.50
Old carwheels	13.50 to 14.00
Old steel rails, rerolling	17.00 to 17.50
Old steel rails, less than 3 ft.	16.50 to 17.00
Heavy melting steel scrap	15.75 to 16.25
Frogs, switches and guards, cut apart	15.75 to 16.25
Shoveling steel	15.25 to 15.75
Steel axle turnings	11.50 to 12.00

Per Net Ton

Iron angles and splice bars	$17.00 to $17.25
Iron arch bars and transoms	18.00 to 18.50
Steel angle bars	14.00 to 14.50
Iron car axles	19.50 to 20.00
Steel car axles	21.50 to 22.00
No. 1 railroad wrought	15.75 to 16.00
No. 2 railroad wrought	14.50 to 15.00
Cut forge	14.50 to 15.00
No. 1 busheling	12.25 to 12.75
No. 2 busheling	9.00 to 9.50
Pipes and flues	10.75 to 11.25
Steel knuckles and couplers	15.00 to 15.50
Steel springs	15.25 to 15.75
No. 1 boilers, cut to sheets and rings	10.25 to 10.75
Boiler punchings	13.75 to 14.25
Locomotive tires, smooth	17.00 to 17.50
Machine shop turnings	7.75 to 8.00
Cast borings	7.00 to 7.25
No. 1 cast scrap	13.25 to 13.75
Stove plate and light cast scrap	10.75 to 11.00
Grate bars	11.00 to 11.25
Brake shoes	10.25 to 10.75
Railroad malleable	13.50 to 14.00
Agricultural malleable	11.25 to 11.75

Philadelphia

PHILADELPHIA, PA., Feb. 29, 1916.

Railroad freight embargoes are more severe than ever, and come nearer home, inasmuch as Philadelphia is now under the ban, as well as Coatesville and Burnham, Pa., and New England points. Other places are threatened. Southern points are being helped by the existing conditions, as in the case of a fabricator at Richmond, Va., who can now get material, whereas he could not a few weeks ago. Getting coke to blast furnaces is a serious problem, while pig iron is being made faster than it can be shipped. Conditions are expected to get worse rather than better. No changes are noted in bars, plates and shapes, except that the volume of demand is reported to be greater than ever, and the same is true of billets and sheets. A maker who has restricted his forward selling is about to open his books for third quarter plates, billets and sheets. Pig iron has been comparatively quiet, but quotations are a trifle firmer, and a buying movement is looked for in the near future. Several thousand tons of ferromanganese have been taken for last half delivery, and more business could be done, if the English makers gave the word. The demand is good for spiegeleisen as a protection against the dearth of more desirable material. Bessemer ferrosilicon has been advanced $3 per ton. A good business has been done in contract foundry coke. Old material is practically unchanged.

Pig Iron.—In comparison with some recent weeks, the past one has been rather quiet, although a good tonnage has been taken in a quiet way. More encouraging than the sales is the manner in which consumers are pressing for deliveries, indicating that they are busy and that their stocks are becoming depleted. No large inquiries are reported. Those before the trade call mostly for lots of less than 500 tons, deliveries ranging from prompt to last half. It is generally believed that a good buying movement is not far off, also that more iron for delivery in the second quarter will be taken. The railroad freight embargoes are worse than ever, and a source of distress to both producers and consumers. They now prohibit deliveries to Philadelphia, Coatesville, New England, and all shipments to the East from points west of Pittsburgh. Burnham, Pa., is affected and other points where freight is accumulating are threatened. Freight cannot be moved from Buffalo to New England points. Virginia furnaces that cannot get their product into New England are making iron faster than it is being shipped. Blast furnaces are further hampered by difficulty in getting coke, even where excess quantities have been shipped. How serious the situation is in this respect is indicated by the action of one iron company in sending its own men along railroad lines to locate coke which has been side-tracked. Other cases are mentioned where foundries in actual need of iron cannot be relieved. At some of the terminals and sidings, switching cannot be done without interfering with traffic on main lines, and this is not an infrequent cause of holding up shipments which might otherwise be delivered. Nothing of interest is noted in basic except that supplemental buying of 7500 tons by a large eastern Pennsylvania plate mill brought the aggregate of its purchases up to 85,000 tons. The price paid for the additional iron was $19.50, delivered. Low phosphorus has been quiet, but is strong at about $32, Philadelphia. Prices are firm for all grades and the recent evidences of weakness in foundry iron have about disappeared. Eastern Pennsylvania makers quote No. 2 X at $20, furnace, and Virginia makers adhere to $18, furnace. Quotations for standard brands, delivered in buyers' yards, prompt shipment, range about as follows:

Eastern Pa., No. 2 X foundry	$19.75 to $20.75
Eastern Pa., No. 2 plain	19.50 to 20.50
Virginia, No. 2 X foundry	20.75
Virginia, No. 2 plain	20.25
Gray forge	19.00 to 19.50
Basic	19.50 to 20.00
Standard low phosphorus	$32.00

Iron Ore.—The only arrival at this port in the week ended Feb. 26 consisted of 7400 tons from Cuba.

Ferroalloys.—In the past few days several thousand tons of 80 per cent ferromanganese for last half delivery have been eagerly taken by consumers at $150, seaboard. The supplies of some of the steel casting plants in this district are running low, and their managers are canvassing the sellers. Some of them expect to be compelled to use spiegeleisen and they are buying it where they can, but this product is nearly as scarce as ferromanganese. The quotation for 20 per cent spiegeleisen is $50, furnace. Bessemer ferrosilicon has been held at $29, furnace, or $32.44, Philadelphia, but yesterday a Western maker announced an advance of $3 per ton on Bessemer and $2 on silvery grades, making the delivered price of Bessemer $35.44, Philadelphia. The silvery grades are usually quoted $2 per ton under Bessemer, but the difference is now $3. An offering of 3000 tons of ferromanganese, last half delivery, was sold in a few minutes a little over a week ago with the mere assistance of the telephone, and not all the buyers could be satisfied. A second lot of 3000 tons was apportioned among consumers, each getting 50 per cent of what he wanted. A shipment of 663 tons arrived here last week from England. Fifty per cent ferrosilicon, forward delivery, is quoted at $83 to $85, Pittsburgh.

Bars.—Consumers are searching the market for steel bars, while makers are putting forth no effort to sell. The nominal quotation is 2.409c., Philadelphia. Makers of iron bars have advanced their quotation $3 per ton, now asking 2.559c., Philadelphia, for carload lots. Less than carloads command $3 per ton higher.

Plates.—The minimum quotation for plates is 3c., Pittsburgh, or 3.159c., Philadelphia, with one maker quoting 3.25c., Pittsburgh, or 3.409c., Philadelphia, as his bottom price. With the mills filled up, the great question is where plates can be obtained in the next few months. Inquiry is more persistent than ever, especially from the builders of locomotives and cars. The Lenoir Car Works has not been able to place its order for several thousand tons.

Structural Material.—Eastern Pennsylvania mills continue to quote 2.409c., Philadelphia, as their minimum on desirable orders, and they ask 2.659c. on miscellaneous material, even in carload lots. A few building propositions involving about 200 tons each are pending in this territory, a new one being a building for the Carpenter Steel Company, Reading, Pa.

Billets.—One maker is not quoting at all, and the nominal prices of another are $42 to $48 for open-hearth rerolling billets, and $55 to $65 for forging billets. The latter price has been paid. The maker quoting the prices mentioned has not opened his books for the third quarter. Billets made from the croppings obtained in the manufacture of shell rounds are to be had, and are suitable for some purposes. The quotation for rounds is about 3.50c.

Rails.—Some additional tonnages of rails are being talked of, but orders will depend on the deliveries which can be made.

Old Material.—Were it not for the embargoes, business would be very good, but brokers find it difficult to move material to many points. The taking of large quantities at Pittsburgh has strengthened the market here, but prices are unchanged. Quotations for delivery in buyers' yards in this district, covering eastern Pennsylvania, and taking freight rates from 35c. to $1.35 per gross ton, are as follows:

No. 1 heavy melting steel	$16.50 to $17.00
Old steel rails, rerolling	19.00 to 20.00
Low phos. heavy melting steel scrap	21.50 to 22.50
Old steel axles	25.00 to 26.00
Old iron axles	27.00 to 28.00
Old iron rails	19.50 to 20.00
Old carwheels	16.50 to 17.00
No. 1 railroad wrought	21.50 to 22.00
Wrought-iron pipe	14.75 to 15.25
No. 1 forge fire	14.00 to 14.50
Bundled sheets	14.00 to 14.50
No. 2 busheling	11.00 to 11.50
Machine shop turnings	9.50 to 10.00
Cast borings	11.00 to 11.50
No. 1 cast	17.00 to 18.00
Grate bars, railroad	12.50 to 13.00
Stove plate	13.00 to 13.50
Railroad malleable	15.00 to 15.50

Sheets.—The market is strong at 3c. to 3.25c., Pittsburgh, or 3.159c. to 3.409c., Philadelphia, for No. 10 blue annealed. It is expected that third quarter busi-

ness will be taken soon, in view of the pressure on the principal Eastern maker.

Coke.—Foundry coke has been fairly active, and several contracts have been made at $3.50 per net ton at oven. Spot foundry is quoted at $4 to $4.50 per net ton at oven, a range with which the upset freight condition has much to do. Spot furnace is quoted at $3.50 to $3.75, and contract at $2.50 to $2.75 per net ton at oven. Freight rates from the principal producing districts are as follows: Connellsville, $2.05; Latrobe, $1.85, and Mountain, $1.65.

Buffalo

BUFFALO, N. Y., Feb. 29, 1916.

Pig Iron.—The market is fundamentally strong, notwithstanding that a local maker has taken important business during the week at a figure slightly below the schedule held to by the other leading producers. One producer has sold a considerable amount of basic iron in nearby districts. One of the principal companies states that sales do not reach larger proportions because there is little available tonnage untaken for an extended period ahead. On some grades this company is booked through the entire first half and on others through the third quarter and into the forepart of the fourth quarter. Another interest has sold so far in advance as to be now virtually out of the market. Sellers believe that the signs of increasing activity among melters will bring about a stiffening in prices in the near future in keeping with the recent increase in finished steel prices. Quotations that have been in effect the past two weeks are being firmly adhered to by all interests except the one mentioned that temporarily shaded its prices to secure a desired advance tonnage on its books. For No. 2 X foundry, $18.75 to $19 is being quoted for such lots as are available for delivery up to July 1, but for delivery over the last half the price for this grade has already stiffened to $19 to $19.25. The same advance of approximately 25c. per ton above the first half schedule quoted below is being asked for last half delivery on the other grades. We quote as follows for delivery through first half, f.o.b. furnace, Buffalo:

No. 1 foundry	$19.00 to $19.50
No. 2 X foundry	18.75 to 19.00
No. 2 plain	18.50 to 18.75
No. 3 foundry	18.50
Gray forge	18.50
Malleable	19.00 to 19.50
Basic	19.00 to 20.00
Charcoal, regular brands and analysis	21.00 to 22.00

Finished Iron and Steel.—Some of the selling agencies report that the lid is clamped down tighter than ever so far as the taking on of new tonnage is concerned and that even applications for contracts from customers of long standing are being declined because of inability of mills to make shipment during the last half of this year, and their unwillingness to entertain obligations that will carry over into 1917. It is reported that other selling agencies are considering special applications from preferred customers for third quarter contracts, with the distinct understanding that shipments are to be made at the seller's convenience. Reports have come to hand from Canadian territory that, because of the high price now asked for structural shapes, the duty, with war tax added, makes the cost of structural material considerably higher than reinforced concrete construction. As reinforcing bars are being rolled in Canada and not subject to duty or war tax, several large contracts closed during the week went to reinforced concrete instead of structural steel as first planned. The Ferguson Steel & Iron Company, Buffalo, has received contracts for 600 tons of steel for a new forging plant for the Sizer Forge Company, this city; 150 tons for the Gleason Works, Rochester; 300 tons for the Picadilly Theater, Rochester; 150 tons for a business block for D. R. Roberts, Jamestown, and 100 tons for a bath house at the plant of the Schoellkopf Aniline & Chemical Works, Buffalo.

Old Material.—The market is strong except for cast scrap, which shows some weakness with a slight decrease in price, and old carwheels, which also show a little tendency toward softness but not sufficient, so far, to occasion a quotable change. The demand for other lines is such as to indicate the probability of advances shortly. As noted last week, increasing inquiry is before the market for heavy melting steel. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel	$16.50 to $17.00
Low phosphorus steel	21.00 to 21.50
No. 1 railroad wrought scrap	19.00 to 19.50
No. 1 railroad and machinery cast, scrap	16.00 to 16.50
Old steel axles	24.00 to 24.50
Old iron axles	24.00 to 24.50
Old carwheels	15.25 to 15.75
Railroad malleable	15.25 to 15.75
Machine shop turnings	7.75 to 8.25
Heavy axle turnings	12.00 to 12.50
Clean cast borings	9.25 to 9.75
Old iron rails	17.50 to 18.00
Locomotive grate bars	11.50 to 12.00
Stove plate (net ton)	11.00 to 11.50
Wrought pipe	13.00 to 13.50
Bundled sheet scrap	12.00 to 12.50
No. 1 busheling scrap	14.50 to 15.00
No. 2 busheling scrap	11.00 to 11.50
Bundled tin scrap	15.00 to 15.50

Cincinnati

CINCINNATI, OHIO, March 1, 1916—(*By Wire.*)

Pig Iron.—Sales of basic in this territory made in the past 10 days will run over 60,000 tons. It is rumored that another nearby consumer will probably close soon for a last half supply. The Lake furnaces secured a large part of the sales mentioned, but a considerable tonnage was awarded to Ironton producers. Foundry iron is very active, but more sales of Northern foundry have been made than of Southern. The Ohio silvery irons are still in demand and the price has been raised $2 per ton, making it $27 at furnace on an 8 per cent analysis. Bessemer ferrosilicon has advanced $3 per ton, making the furnace price $31 for 10 per cent. A few sales of malleable were made last week, but the demand is not quite so brisk as in the previous week. Among the sales of Southern foundry iron reported is one of 1100 tons to a central Ohio melter for July-October shipment. A Kentucky melter took 1800 tons for April-October. Several sales around 500 tons were made to Ohio consumers, all for last half shipment, and for the same delivery various Indiana melters purchased lots ranging from 500 to 1500 tons. Northern iron sales include several in central and northern Ohio for various good-sized tonnages and in Indiana two 1000-ton sales were reported and a number of small ones. An Indiana firm also bought 5000 tons of malleable. The past two weeks are said by local iron merchants to have been the most satisfactory period they have had in a long while. Southern No. 2 foundry is quoted at $15 to $15.50, Birmingham basis, for first half shipment and from $15.50 to $16 for last half. Northern iron ranges from $18 to $18.50, Ironton, and it is reported that the furnaces in that territory will soon mark up prices to the last-named figure. Based on freight rates of $2.90 from Birmingham and $1.26 from Ironton, we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft.	$18.40 to $18.90
Southern coke, No. 2 f'dry and 2 soft.	17.90 to 18.40
Southern coke, No. 3 foundry	17.40 to 17.90
Southern No. 4 foundry	16.90 to 17.40
Southern gray forge	16.40 to 16.90
Ohio silvery, 8 per cent silicon	28.26 to 28.76
Southern Ohio coke, No. 1	20.26 to 20.76
Southern Ohio coke, No. 2	19.26 to 19.76
Southern Ohio coke, No. 3	18.76 to 19.26
Southern Ohio malleable Bessemer	19.26 to 19.76
Basic, Northern	19.26 to 19.76
Lake Superior charcoal	21.20 to 22.20
Standard Southern carwheel	25.40 to 25.90

(*By Mail*)

Coke.—Coke is stronger, both for prompt and deferred shipment. Prompt Connellsville furnace coke is quoted at $3.50 to $3.75 per net ton at oven and contract figures range from $2.25 to $2.60; prompt Connellsville foundry, $3.60 to $4, and contract from $3.25 to $3.75; Wise County and Pocahontas furnace, $2.50 to $3 and foundry, $3.50 to $4. No business in furnace coke is reported in this territory, and foundry contracting, while showing some improvement, is still light.

Finished Material.—All prices have advanced sharp-

Some business is reported even at the advanced prices, and the outlook is much better for structural material of different kinds, such as twisted steel bars, for which there is a very good demand. We quote steel bars from stock at 3c., base; twisted steel bars, 3.15c.; rounds and squares, 2-in. and over, 3.50c.; plates, ¼-in. and thicker, 3.50c.; structural shapes, 3c.; No. 10 blue annealed, 3.25c.; No. 28 galvanized sheets, 5c. An advance on the warehouse price of galvanized sheets is scheduled for March 1. The mill price on No. 28 galvanized sheets is unchanged at 5.15c., Cincinnati, or Newport, Ky., but No. 28 black sheets have been advanced to 3.05c.

Old Material.—Business has shown some improvement, but only in spots. Yard stocks are said to be accumulating faster than they can be moved, while some grades of scrap are advancing borings and turnings show weakness. The minimum prices given below represent what dealers are willing to pay for delivery in their yards, southern Ohio, and Cincinnati, and the maximum quotations are dealers' prices f.o.b. at yards.

Per Gross Ton	
Bundled sheet scrap	$10.50 to $11.00
Old iron rails	15.25 to 15.75
Relaying rails, 50 lb. and up	21.50 to 22.00
Rerolling steel rails	14.00 to 15.00
Heavy melting steel scrap	14.00 to 14.50
Steel rails for melting	13.75 to 14.75
Per Net Ton	
No. 1 railroad wrought	$13.25 to $13.75
Cast borings	6.50 to 7.00
Steel turnings	6.25 to 6.75
Railroad cast scrap	11.50 to 11.75
No. 1 machinery scrap	13.25 to 13.75
Burnt scrap	8.50 to 9.00
Iron axles	19.00 to 19.50
Locomotive tires (smooth inside)	13.00 to 13.50
Pipes and flues	10.00 to 10.50
Malleable and steel scrap	10.50 to 11.00
Railroad tank and sheet scrap	8.50 to 9.00

Cleveland

CLEVELAND, OHIO, Feb. 29, 1916.

Iron Ore.—The market is dull although a few small lot sales are reported, these ranging from 10,000 to 15,000 tons. The movement of ore from the docks has been rather light during February. The January shipments were very heavy so that furnaces are well supplied. Shipments are expected to pick up early in March as soon as weather conditions are more favorable. We quote as follows, delivered at lower Lake ports: Old range Bessemer, $4.45; Mesaba Bessemer, $4.20; old range non-Bessemer, $3.70; Mesaba non-Bessemer, $3.55.

Pig Iron.—The buying movement reported a week ago still continues. A heavy tonnage of foundry iron has been sold in Cleveland and the surrounding Northern Ohio territory during the past week and the market is active in adjoining districts. The activity brought out some concessions in prices in the Valley, where foundry iron was offered last week at $18.25 for No. 2 and sales were made even down to $18.05 to meet the price of Cleveland furnaces for Cleveland delivery. Sellers claim, however, that no more Valley iron can be had below $18.50. Cleveland prices are firm at $18.50 for outside shipment and $19, delivered Cleveland. The Toledo price has been advanced to $19.25 for No. 2. In steel making iron the Kokomo Steel & Wire Company has taken 25,000 tons from a Lake furnace at about $18. Basic iron is firm and is being quoted as high as $18.50 in the Valley. Southern iron is in fair demand and some sellers have advanced prices 50c. a ton to $15.50 for first half and $16 for the last half. Several Ohio consumers are buying additional Southern iron for the first half, their melt having increased to such an extent that they will consume more iron than they expected. The price of Jackson County silvery iron was advanced yesterday $2 a ton to $27 at furnace for 8 per cent for delivery through this year and Jackson County Bessemer ferrosilicon was advanced $3 a ton. Silvery iron is active in the Michigan territory. We quote, delivered Cleveland, as follows:

Bessemer	$20.95 to $21.45
Basic	18.70 to 19.00
Northern No. 2 foundry	19.00
Southern No. 2 foundry	19.50 to 20.00
Gray forge	18.25
Jackson Co. silvery 8 per cent silicon	28.62
Standard low phos., Valley furnace	32.00

Finished Iron and Steel.—There is considerable inquiry for steel for early shipment for which consumers are paying high prices, and the pressure for delivery on contracts continues. An Eastern mill has sold universal plates as high as 3.35c. for delivery to this city. The demand for hard steel bars for reinforcing purposes is very heavy and the market is now established at 2.35c. Pittsburgh, mills being able to make deliveries in 30 to 60 days. Some of the implement manufacturers are large consumers of hard steel bars but have not yet closed contracts for this steel in the Cleveland territory. Few of the implement makers are under contract for their other steel requirements for the last half delivery. Iron bars are unchanged at 2.25c., Pittsburgh. The Pennsylvania Steel Company has taken 5000 tons of structural material for a bridge at Louisville, and 3000 tons for an apartment house in Toledo, and the King Bridge Company, 500 tons of structural steel for a bridge in Youngstown. The Carnegie Steel Company has taken 5000 tons of rails for the Wheeling & Lake Erie Railroad and 1500 tons of rails and 20,000 steel ties for traction lines in and about Cleveland. Another inquiry for 10,000 steel ties is pending. Wire has been sold at 2.40c. base in Cleveland or $5 a ton above the recent market for delivery at the convenience of the mill. Sheets are firmer and in good demand particularly for blue annealed and black sheets in heavy gages and wide sizes. We quote black sheets at 2.75c. to 2.95c. Ohio mill for No. 28; blue annealed at 2.95c. to 3c. for No. 10 and galvanized at 5c. to 5.25c. Warehouse prices are unchanged at 3c. for steel bars, 3.15c. for plates and 2.95c. for iron bars.

Bolts, Nuts and Rivets.—The demand for bolts and nuts continues heavy. Prices are very firm. Rivets are in active demand with prices maintained at the recent advance. Bolt and nut discounts are as follows:

Common carriage bolts, ⅝ x 6 in., smaller or shorter, rolled thread, 65 & 5; cut thread, 65; larger or longer, 50 & 15; machine bolts with h.p. nuts, ⅝ x 4 in., smaller and shorter, rolled thread, 65 & 10; cut thread, 65 & 5; larger and longer, 50 & 20; lag bolts, gimlet or cone point, 65, 10 & 5; square h.p. nuts, blank or tapped, $3.70 off the list; hexagon, h.p. nuts, blank or tapped, $3.80 off; c.p.c. & t. square nuts, blank or tapped, $3.50 off; hexagon nuts all sizes, $4.25 off; cold pressed semi-finished hexagon nuts, all sizes, 75 & 10 off.

Old Material.—The market is somewhat firmer and a better feeling prevails, the report of heavy buying by the Carnegie Steel Company in Pittsburgh having a sentimental effect on the local situation. There is not much activity, however, and trading is mostly between dealers. Heavy melting scrap is about 50c. a ton higher and railroad grate bars, stove plate and railroad wrought have been marked up. A sale of railroad wrought is reported at $18.50. Borings and turnings are weak, sales of the latter being made at $7.25 to $7.50. Busheling is dull. We quote f.o.b. Cleveland as follows:

Per Gross Ton	
Old steel rails	$16.50 to $17.00
Old iron rails	19.00
Steel car axles	25.00 to 26.00
Heavy melting steel	16.00 to 16.50
Old carwheels	14.00 to 14.50
Relaying rails, 50 lb. and over	22.50
Agricultural malleable	14.00 to 14.25
Railroad malleable	16.75 to 17.00
Steel axle turnings	13.25 to 13.50
Light bundled sheet scrap	13.25 to 13.50
Per Net Ton	
Iron car axles	$23.00 to $24.00
Cast borings	8.50 to 8.75
Iron and steel turnings and drillings	7.25 to 7.75
No. 1 busheling	14.25 to 14.50
No. 1 railroad wrought	17.50 to 18.00
No. 1 cast	13.75 to 14.25
Railroad grate bars	11.50 to 12.00
Stove plate	11.50 to 11.75

Coke.—The foundry coke market is more active owing to the fact that some consumers are placing contracts. Prices are very firm and quotations on foundry coke for prompt shipment continue very high owing to the scarcity and car shortage. We quote best makes of standard Connellsville foundry coke at $3.75 to $4 per net ton at oven for last half; $3.50 for delivery through the twelve months from July 1 and $4.50 to $5 for prompt shipment. Some Virginia coke has been sold at $4 at oven for a year's contract. Contracts for Indiana by-product coke are being placed on Connellsville basis of $4 for the year. Connellsville furnace coke is quoted at $3.50 to $3.75 for prompt shipment.

Pittsburgh

PITTSBURGH, PA., Feb. 29, 1916.

There seems no end to the advances in prices and the whole steel market is running away. In the past week, Bessemer iron went up 50c. to 75c. per ton; basic, 25c. to 50c.; ferrosilicon, $3; light rails, $3; skelp, $2; wire products, $2; shafting, $5; spikes, $2 to $3; refined iron bars, $2; merchant steel, $3 to $4; cold-rolled strip steel, $5 or more; black iron and steel pipe, $2; galvanized pipe, $4; boiler tubes, $2; heavy steel scrap, 75c. to $1. Manufacturers of steel consider that prices are at dangerous levels, but there seems to be no way to hold them in check. There are serious misgivings as to what will happen when the tide turns, as it must sooner or later. Consumers are much perplexed as to what course to pursue. They are afraid to hold back placing orders for fear of not getting in on rolling schedules, and at the same time they hesitate to make contracts for deliveries months ahead, at the abnormally high prices the mills are quoting. The volume of specifications seems to be getting larger, and with the bad railroad situation mills are not catching up on deliveries, but are steadily getting further behind. All kinds of predictions are being made as to future prices, 3c. and higher being named on contract plates, shapes and bars, $3 on wire nails and other finished articles in proportion. The mills are so congested with business that they are utterly unable to satisfy customers in deliveries. Nothing is in sight as yet to indicate any halt in demand or in advances in prices; on the contrary, all signs point to still higher levels. It is more and more not a question of the price the customer will have to pay, but where he can find a mill that will enter his order for delivery in four or five months, and at practically whatever price the mill cares to put in the contract.

Pig Iron.—There has been a heavy movement in basic iron with some fair sized sales of Bessemer. The Jones & Laughlin Steel Company is credited with having bought from local interests 30,000 to 35,000 tons of basic for third quarter delivery at $18, Valley furnace, The Standard Steel Works Company, Thurlow, Pa., is inquiring for 15,000 tons of basic; John A. Roebling's Sons Company, 3000 tons; Follansbee Brothers Company, 9000 tons, and National Malleable Castings Company, 10,000 tons. The Allegheny Steel Company is expected to buy some basic. The McConway-Torley Company wants about 2000 tons of Bessemer; Union Steel Casting Company, 1500 tons. The Standard Sanitary Mfg. Company has bought about 3000 tons of Southern No. 2 foundry for its Louisville plant at a shade under $15, Birmingham. Other large inquiries for foundry are in the market. The heavy buying and the active inquiries have stiffened up prices. We note sales of 3000 tons of Bessemer iron at $20.50, Valley furnace; 2000 tons at the same price for second quarter, and 1200 tons, delivered 200 tons a month in last half, at $21. Indications are that several large blocks of basic iron will be sold before this week is out. W. P. Snyder & Co. report the average price of Bessemer pig iron in February to have been $20.2136, Valley furnace, an advance of 28c. per ton over January, and the basic average $17.984, an advance of 15c. per ton over January. We have advanced prices on basic, Bessemer and foundry iron and now quote: Standard Bessemer iron, $20.50; basic, $18 to $18.25; malleable Bessemer, $18.50 to $18.75; gray forge, $17.50 to $17.75, and No. 2 foundry, $18.50 to $19, all at Valley furnace, the freight rate for delivery in the Pittsburgh and Cleveland districts being 95c. per ton.

Billets and Sheet Bars.—As indicating the strength of the steel market and the scarcity of steel, we can state that a local interest was offered 3000 tons of sheet bars, deliveries 1000 tons a month March, April and May, at $40 per ton, and turned the offer down, not because of the price, but for the reason that it could not spare the steel. The price of open-hearth billets and sheet bars on new orders is about $40, maker's mill, and sales of open-hearth billets have been made at this price. Bessemer billets and sheet bars are also very close to this figure, but consumers have sliding scale contracts which give them their billets and sheet bars at much lower figures. We note a sale of 500 tons of ordinary carbon forging billets for last half delivery at $57 per ton, f.o.b. Pittsburgh. Prices which consumers would have to pay for billets and sheet bars, buying in the open market, are about as follows: Bessemer billets and sheet bars, $36 to $38; open-hearth billets and sheet bars, $38 to $40, maker's mill, Pittsburgh or Youngstown district. We quote forging billets at $55 to $57, for sizes up to but not including 10 x 10 in., and for carbons up to 0.25, the regular extras being charged for larger sizes and higher carbons. Forging billets running above 0.25 and up to 0.60 carbon take $1 per ton extra.

Ferroalloys. — The ferromanganese situation is tighter than ever, and prompt material from stock is quoted at $250 per ton. Prices on English 80 per cent for last half delivery are still quoted at $150, and some round sales have been made at that figure. Ferrosilicon is fully as scarce or more so than ferromanganese, and prices are purely nominal. We quote 50 per cent ferrosilicon up to 100 tons at $85; over 100 tons, and up to 600 tons, $84, and over 600 tons, $83, all per gross ton, delivered in the Pittsburgh district. It is doubtful, however, whether this material can be obtained at these prices. Sales of 35 per cent spiegeleisen have been made at $100 to $105 per ton. The Dunbar Furnace Company, Dunbar, Pa., is quoting 18 to 22 per cent spiegeleisen at $50 for delivery over remainder of this year. Heavy sales of Bessemer and silvery ferrosilicon have been made for delivery over remainder of the year, over 10,000 tons reported as having been sold. One furnace is said to be out of the market now for the remainder of this year. Bessemer ferrosilicon has been advanced $3 per ton, and silvery $2. Prices of Bessemer ferrosilicon for delivery over the remainder of the year are now as follows: 9 per cent, $30; 10 per cent, $31; 11 per cent, $32; 12 per cent, $33; 13 per cent, $34.50; 14 per cent, $36.50; 15 per cent, $38.50, and 16 per cent, $41. Seven per cent silvery for the same delivery is $26.50; 8 per cent, $27; 9 per cent, $27.50; 10 per cent, $28; 11 per cent, $29, and 12 per cent, $30. All these prices are f.o.b. at furnace, Jackson, Ohio; New Straitsville, Ohio, or Ashland, Ky., each of these points having a freight rate of $2 per gross ton to Pittsburgh.

Plates.—The Wabash-Pittsburgh Terminal Railroad has ordered 750 steel gondola cars from the Pressed Steel Car Company; Chicago Great Western, 200 center construction cars from the Standard Steel Car Company, and the Lackawanna Steel Company has ordered 700 steel hoppers from the same interest and the same number from the American Car & Foundry Company. The Southern Pacific has placed 300 steel tank cars with the American Car & Foundry Company. The Carnegie Steel Company has recently entered heavy orders for rolled and forged steel plates for the Lima Locomotive Corporation and American Locomotive Company. This interest is sold out on plates for this year, and has taken some contracts for first quarter of 1917. We quote ¼-in. and heavier plates at 2.25c. for delivery in last quarter, and 2.75c. to 3c. for delivery in second and third quarters.

Structural Material.—New orders are heavy and fabricating shops are filled up for six to eight months. The McClintic-Marshall Company has taken about 1500 tons for new factory buildings for the Gier Pressed Steel Company, Lansing, Mich.; 900 tons for a mixer building for the Youngstown Sheet & Tube Company, and about 500 tons for new shops for the International Steel & Iron Company, Evansville, Ind. The Fort Pitt Bridge Works has taken 350 tons of bridge work for the Baltimore & Ohio, and that road is in the market for about 3000 tons more. Bids have gone in on 5000 to 6000 tons for new steel buildings for the new open-hearth steel plant for the Whitaker-Glessner Company. The American Bridge Company has closed a contract with the Ohio-West Virginia Bridge Company to erect a single track steel bridge of the cantilever type across the Ohio River at Steubenville. It is for the LaBelle Iron Works and will be used for hauling coke from Kopper's by-product ovens now being built to its blast furnaces. The bridge will require about 5000 tons of

steel. The American Bridge Company has also taken a contract to build for the Bessemer & Lake Erie Railroad a double track steel bridge across the Allegheny River above Oakmont, Pa., near Pittsburgh, that will take 10,000 tons or more. Deliveries of shapes by the mills are very unsatisfactory, and they are congested with orders. We quote beams and channels up to 15-in. at 2.25c. at mill for shipment at convenience of the mill, and 2.50c. to 2.75c. for delivery in six to eight weeks.

Steel Rails.—In standard sections and light rails the Carnegie Steel Company has none to offer for delivery before third quarter. Only routine orders for standard sections are being placed, but the demand for light rails is heavy, running 5000 tons a week or over. The three Edgar Thomson mills of the Carnegie Company are pretty well filled up for standard sections, light rails and sheet bars to October. Light rails are up $3 per ton and we now quote: 25 to 45-lb. sections, 1.85c.; 16 and 20-lb., 1.90c.; 12 and 14-lb., 1.95c., and 8 and 10-lb., 2c., in carload lots. An advance of 5c. per 100 lb. is charged for less than carloads and down to three tons, while under three tons an additional 5c. is charged. We quote standard section rails of Bessemer stock at 1.25c. and of open-hearth steel, 1.34c., Pittsburgh.

Sheets.—Mills report new demand and specifications still heavy, beyond their capacity to supply to customers as promptly as wanted. On blue annealed and electrical sheets mills are sold up to July or longer. Sheet bars are scarce and deliveries are deferred, this restricting to some extent the output of sheets. It seems certain that prices on all grades of sheets will be higher in the near future. For delivery in second quarter we quote: Nos. 9 and 10 blue annealed sheets, 2.65c. to 2.75c.; No. 28 Bessemer black, 2.60c.; open-hearth, 2.70c.; No. 28 galvanized sheets from Bessemer stock, 4.75c., and from open-hearth, 4.85c., at maker's mill. We quote Nos. 22 and 24 black plate, tin mill sizes, H. R. and A., 2.40c.; Nos. 25, 26 and 27, 2.45c.; No. 28, 2.50c.; No. 29, 2.60c., and No. 30, 2.70c. These prices are for carloads and larger lots, f.o.b. maker's mill, but some makers are quoting higher figures.

Tin Plate.—As yet nothing has been done with the inquiry from Asia for 360,000 boxes, but there is still a chance that the business will come to this country. Export inquiry is heavy, but mills are sold so far ahead they cannot quote on much of it. Shipments of hot-rolled sheets and tin mill products in February with some mills made a new record in spite of the short month. Prices are very strong. We continue to quote 14 x 20 coke plates at $4 per base box, and 200-lb. base, common ternes, 8-lb. coating, at $6.90 to $7 per box.

Railroad Spikes.—The new demand for railroad spikes is not active, but for barge and boat spikes is heavy. Prices have been advanced, ranging from $2 to $6 per ton. We now quote:

Standard railroad spikes, 4½ x 9/16 in. and larger, $2.50; railroad spikes, ½ and 7/16 in., $2.60 base; railroad spikes, ⅜ in. and 5/16 in., $2.90 base; boat spikes, $2.65 base, all per 100 lb., f.o.b. Pittsburgh.

Wire Rods.—Any prices quoted on wire rods are purely nominal, as local makers say they have not been selling in the open market except to regular customers, in a limited way, for some months. Export inquiry is still active, but very few rods are being sold for foreign shipment as the domestic demand alone is more than the mills can handle. We quote Bessemer, open-hearth and chain rods at nominally $50 per ton, f.o.b. maker's mill.

Wire Products.—Effective Tuesday, Feb. 29, prices on all wire products were again advanced $2 per ton. Makers predict $3 for wire nails by July 1. There is a severe shortage in the supply of nails, especially on the 6, 8 and 10d. sizes. It is said that fully 30 per cent of the wire nails sold are the 8d. size and these are very hard to obtain. Local makers are not quoting on much new business, as they are filled up for four or five months and are very much back in shipments. Prices quoted by the mills to the large trade only, on which shipments would not be promised inside of three or four months, are as follows: Wire nails, $2.40; galvanized, 1 in. and longer, taking an advance over this price of $2, and shorter than 1 in., $2.50; plain annealed wire, $2.25; galvanized barb wire and fence staples, $3.25; painted barb wire, $2.55; polished fence staples, $2.55; cement coated nails, $2.30 base, all f.o.b. Pittsburgh, with freight added to point of delivery, terms 60 days, net, less 2 per cent off for cash in 10 days. Discounts on woven wire fencing are one point lower and are now quoted at 62½ per cent off list for carload lots; 61½ per cent for 1000-rod lots and 60½ per cent for small lots, f.o.b. Pittsburgh.

Cold-Rolled Strip Steel.—This material is steadily going up and makers are now quoting $5 base, minimum, and as high as $5.50. We note a sale of over 100 tons of cold-rolled strip steel, deliveries to start in June, at $5.10 base, and about 125 tons, deliveries to start later, at $5.40 base. We now quote cold-rolled strip steel at $5 to $5.50 base, for delivery at convenience of the mill, extras which are standard with all the makers, being in part as follows:

Base price for 1½-in. and wider, hard, in coils, 0.10 to 0.19 carbon. Extras for size, annealing, cutting, etc., as follows:

Thickness	0.100-in. and thicker	0.050-in. to 0.099-in.	0.036-in. to 0.049-in.	0.035-in.	0.031-in. to 0.034-in.	0.026-in. to 0.030-in.	0.025-in.	0.020-in. to 0.024-in.
Extra for thickness	...	.05	.20	.20	.35	.45	.45	.55
Extra for annealing	.25	.25	.25	.25	.40	.40	.40	.40
Width Extras								
Under 1½ to 1-in. inc.	.15	.15	.15	.15	.15	.15	.15	.15
Under 1 to ¾-in. inc.	.30	.30	.30	.30	.30	.30	.30	.30
Wider than 6, not over 9-in.	...	...	...	...	...	...	.25	.25
Wider than 9, not over 12-in.	...	...	...	.25	.25	.25	.50	.50
Wider than 12, not over 15-in.	...	...	...	.50	.50	.50	...	...
Cut Lengths Extra								
1-in. and wider	.10	.15	.15	.15	.25	.40	.40	.50
Under 1-in. to our limits	.25	.50	.50	.50	.75	.75	.75	.75

Reductions for carload lots of a size. For orders 18 tons or over, one width and gage, shipment at one time, there is a regular reduction from the net price of 15c. per cwt.

For all tempers other than full hard for flat work add annealing extra.

Skelp.—Mills are sold up for four or five months and prices are higher. We now quote grooved steel skelp at 2.10c. to 2.15c.; sheared steel skelp, 2.25c. to 2.35c.; grooved iron skelp, 2.50c. to 2.60c., and sheared iron skelp, 2.75c. to 2.85c., all delivered to consumers' mills in the Pittsburgh district.

Rivets.—Makers are congested with orders and, with inability to get prompt shipment of steel bars from the mills, are much back in deliveries. Nothing is doing in taking orders for export rivets on account of the railroad embargo. Prices are very strong and likely to be higher. We quote buttonhead structural rivets, ½ in. and larger, at $2.90 to $3 and cone-head boiler rivets at $3 to $3.10 per 100 lb. in car-load lots, f.o.b. Pittsburgh. Smaller lots bring about 10c. advance. Discount on small rivets is now 60, 10 & 10.

Shafting.—Nominal discounts on shafting are 35 per cent in carload lots and 30 per cent in less than carloads, Pittsburgh, but several local makers have taken fairly large orders of shafting at 30 per cent off and for delivery in six to eight months from date of order. The demand is heavier than ever known and buyers readily pay premiums to get deliveries.

Iron and Steel Bars.—The two leading local makers of steel bars are understood to have their output practically sold for the remainder of this year. Specifications are abnormally heavy, and some consumers who have not yet covered are importuning the mills to give them rolling space and at almost any prices the mills care to name. Export inquiries came in this market last week for close to 100,000 tons of steel rounds for shrapnel, but, we are advised, were turned down. Prices on refined iron bars are higher, with the mills sold up for two or three months. Consumers are complaining bitterly of slow deliveries by the mills, but the latter say they are doing the best they can under the most trying conditions they have ever experienced. We quote steel bars at 2.25c. for delivery in third and fourth quarters, and 2.50c. to 2.75c. for delivery in four to five weeks. Prices from warehouse range from 2.75c. up, depending on quantity. We quote refined iron bars at

2.25c. to 2.30c. and railroad test bars at 2.30c. to 2.40c., f.o.b. mill, Pittsburgh.

Hoops and Bands.—The nominal price of bands is 2.25c. and hoops, 2.50c., at mill for such deliveries as the mills can make, which would be in four or five months. Premiums of $3 to $5 per ton are paid for shipment in four to six weeks. We quote steel hoops at 2.50c., and steel bands at 2.25c., with extras on the latter as per the steel bar card. These are mill prices only for greatly deferred deliveries, but, for shipment in six to eight weeks or longer, steel hoops would probably bring 2.75c. and bands 2.50c. at mill.

Nuts and Bolts.—Further advances in prices are looked for in the very near future. The new demand is abnormally heavy and makers are congested with orders and back in shipments ten to twelve weeks or longer. Discounts in effect at this writing, which are said to be for prompt acceptance only, are as follows:

Machine bolts, h. p. nuts, ⅜ x 4 in., smaller and shorter, rolled, 65 and 10 per cent; smaller and shorter, cut, 65 and 5 per cent; larger or longer, 50 and 20 per cent.

Machine bolts, c. p. c. and t. nuts, ⅜ x 4 in., smaller and shorter, 60 and 10 per cent; larger or longer, 50 and 10 per cent.

Common carriage bolts, ⅜ x 6 in., smaller and shorter, rolled, 65 and 5 per cent; smaller and shorter, cut, 65 per cent; larger or longer, 50 and 15 per cent.

Blank bolts, 50 and 20 per cent. Tap bolts, 30 per cent. Bolt ends, with h. p. nuts, 50 and 20 per cent; c. p. c. and t. nuts, 50 and 10 per cent. Stud bolts, rough, 45 per cent; lag screws, cone or gimlet point, 65, 10 and 5 per cent.

Nuts, blank or tapped, h. p. square, 3.70c. lb. off; h. p. hexagon, 3.80c. lb. off; c. p. c. and t. square, 3.50c. lb. off, hexagon, 4.25c. lb. off; c. p. semi-finished, hexagon, 75 and 10 per cent. Finished case hardened nuts, 75 per cent.

Merchant Steel.—Prices quoted are only nominal, as mills are filled up so far ahead they cannot take on more orders for delivery before second half. Specifications are heavy and mills are back in shipments ten to twelve weeks or longer. Prices are higher. On small lots for delivery at convenience of the mill, which would be in third or fourth quarter, we quote: Iron finished tire, ½ x 1½ in. and larger, 2.20c. base; under ½ x 1½ in., 2.35c.; planished tire, 2.40c.; channel tire, ¾ to ⅞ and 1 in., 2.70c. to 2.80c.; 1 x ⅛ in. and larger, 3.10c.; toe calk, 2.80c. to 2.90c. base; flat sleigh shoe, 2.55c.; concave and convex, 2.60c.; cutter shoe, tapered or bent, 3.10c. to 3.20c.; spring steel, 2.80c. to 2.90c.; machinery steel smooth finish, 2.60c.

Carwheels.—It is stated that two or three very large contracts for forged steel carwheels have been placed lately, divided between the two local makers. Prices are strong, but unchanged. We quote 33-in. freight carwheels in lots of 1000 or more at $18; 33-in. tender wheels, $21; 36-in. passenger or tender wheels, $25. These prices are based on a 10-in. diameter hub, 50c. extra being charged for 11-in., all f.o.b. Pittsburgh.

Wrought Pipe.—Effective Tuesday, Feb. 29, discounts on black steel and iron pipe were lowered one point, equal to an advance of $2 per ton, except 13, 14 and 15 in. lap weld, which were lowered two points, or an advance of $4 per ton. Galvanized iron and steel pipe discounts were lowered two points, or an advance of $4. No change was made in discounts on extra strong iron pipe. On double extra strong black and galvanized iron pipe, discounts were lowered three points, or an advance of $6. Oil country goods were advanced 5 to 10 per cent.; water well casing, one point, or $2; line pipe up to 13 in., $2, and over 13 in., $4 per ton. All the pipe mills are running to about 100 per cent, and have heavy orders booked for the next two or three months. The new discounts on both iron and steel pipe are given on another page.

Boiler Tubes.—Effective Tuesday, Feb. 29, discounts on steel and charcoal iron tubes were lowered one point, equal to an advance of $2 per ton. The mills report the demand for locomotive and merchant tubes very heavy, most makers being sold up for two to three months, while on seamless steel tubing the output is sold up for six months or more. The new discounts on tubes are given on another page.

Old Material.—There has been a heavy movement in steel melting scrap, the Carnegie Steel Company being credited with having bought 50,000 tons or more for as prompt delivery as the sellers can make. One leading dealer took 15,000 to 20,000 tons, two others 10,000 tons each, and another about 15,000 tons. It is said the price paid was $18 per gross ton delivered, but the buyer may have been able to pick up a very few small lots at slightly less than $18. Dealers have paid in the last day or two $17.75 for heavy steel scrap and the market is very strong. There has also been a heavy movement in machine-shop turnings for blast-furnace use, and it is said 40,000 to 50,000 tons for this purpose have been sold in the past two weeks or more at prices ranging from $9.75, the lowest, to $10 or better. It has been several years since machine shop turnings have been bought in the open market to be melted in the blast furnace. We note a sale of 200 tons of low phosphorus melting stock at about $20.50, delivered. Dealers quote for delivery in the Pittsburgh and nearby districts that take the same rates of freight as follows, per gross ton:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh delivered	$17.75 to $18.00
Compressed side and end sheet scrap	16.25 to 16.50
No. 1 foundry cast	15.75 to 16.00
Bundled sheet scrap, f.o.b. consumers' mills, Pittsburgh district	14.50 to 15.00
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	18.00 to 18.25
No. 1 railroad malleable stock	15.50
Railroad grate bars	10.75 to 11.00
Low phosphorus melting stock	20.00 to 20.50
Iron car axles	24.50 to 25.00
Steel car axles	26.00 to 26.50
Locomotive axles, steel	24.00 to 24.50
No. 1 busheling scrap	15.00
Machine shop turnings	9.75 to 10.00
Old carwheels	14.50
Cast-iron borings	10.25
*Sheet bar crop ends	18.00 to 18.50
Old iron rails	16.00 to 16.50
No. 1 railroad wrought scrap	18.50 to 19.00
Heavy steel axle turnings	13.50 to 14.00
Heavy breakable cast scrap	13.50 to 14.00

*Shipping point.

Coke.—The car situation is still very bad, and all shippers of coke are back in deliveries. One blast-furnace interest reports that it is 110 cars short of coke and the situation is getting worse. The railroads do not seem to have enough motive power or cars. This condition creates some demand for prompt blast-furnace coke, which is strong at $3.50 to $3.75 per net ton at oven. It is stated that some fairly large contracts for 72-hr. foundry coke have been made recently at $3.50 and $3.75 for best grades at oven for delivery in last half, and in a few cases for delivery for an entire year from July 1. We quote best grades of blast-furnace coke for prompt delivery at $3.50 to $3.75, a few sales having been made at the latter figure. We quote high grade 72-hr. foundry coke for prompt shipment at $3.75 to $4 per ton, and on contracts for last half of the year at $3.50 to $3.75 per net ton at oven. The Connellsville *Courier* gives the output of coke for the week ended Feb. 19 as 418,287 net tons, a decrease over the previous week of 23,022 tons.

St. Louis

ST. LOUIS, MO., Feb. 28, 1916.

Pig Iron.—Demand has kept up but for relatively small lots. As a result prices have stiffened for last half delivery. Sales included 300 tons of Bessemer ferrosilicon.

Coke.—The difficulty of getting coke, both on new sales and existing contracts, continues to be the feature of the market. By-product coke continues to stiffen, being held about with Connellsville coke in price.

Finished Iron and Steel.—Mills are still unwilling to make promises as to delivery and in consequence consumers are turning more and more to the warehouses, which in turn are not so freely accepting orders as they have in the past, desiring to distribute their stocks to the best advantage among their consumers. A local newspaper building, requiring 2000 to 2500 tons, has been awarded to the Christopher & Simpson Company. No plates are to be had at any price and bars are so hard to get that buyers are avoiding business calling for them. In standard section steel rails an inquiry for 5000 tons came out during the week, mostly to feel out

the delivery situation. This may be increased or dropped altogether according as the situation develops. It is regarded as an indication that the Southwestern roads are beginning to think about the future. Warehouses are working night and day to move their orders and no buyers are permitted to accumulate stock from the warehouses. We quote for stock out of warehouse as follows: Soft steel bars, 2.95c.; iron bars, 2.90c.; structural material, 2.95c.; tank plate, 3.20c.; No. 10 blue annealed sheets, 3.15c.; No. 28 black sheets, cold rolled, one pass, 3.20c.; No. 28 galvanized sheets, black sheet gage, 5.25c.

Old Material.—The consuming industries are taking in only such material as they have contracted for and are refusing to buy new lots. Dealers, however, are optimistic, believing that business will become active by March 15 at the latest and are taking and storing material against the future. They pay somewhat lower prices to the railroads, but even at that the roads have evinced a disposition to clean up their stocks. There has been some shipping East and some dealers have made purchases to cover short sales on some classes of material. Generally speaking, however, there has been no large business done and prices are quoted with that fact in view. We quote dealers' prices f.o.b. St. Louis industrial district, customers' works, as follows:

Per Gross Ton

Old iron rails	$15.50 to $16.00
Old steel rails, rerolling	16.50 to 17.00
Old steel rails, less than 3 ft.	16.25 to 16.75
Relaying rails, standard section, subject to inspection	22.00 to 23.00
Old carwheels	13.25 to 13.75
No. 1 railroad heavy melting scrap	15.00 to 15.50
Heavy shoveling steel	13.25 to 13.75
Frogs, switches and guards cut apart	15.00 to 15.50
Bundled sheet scrap	10.00 to 10.50

Per Net Ton

Iron angle bars	$15.00 to $15.50
Steel angle bars	13.00 to 13.50
Iron car axles	20.25 to 20.75
Steel car axles	21.25 to 21.75
Wrought arch bars and transoms	17.50 to 18.00
No. 1 railroad wrought	14.50 to 15.00
No. 2 railroad wrought	14.00 to 14.50
Railroad springs	14.50 to 15.00
Steel couplers and knuckles	14.50 to 15.00
Locomotive tires, 42 in. and over, smooth inside	15.50 to 16.00
No. 1 dealers' forge	11.75 to 12.25
Mixed borings	7.75 to 8.25
No. 1 busheling	12.50 to 13.00
No. 1 boilers, cut to sheets and rings	10.00 to 10.50
No. 1 railroad cast scrap	11.50 to 12.00
Stove plate and light cast scrap	9.25 to 9.75
Railroad malleable	11.25 to 11.75
Agricultural malleable	10.25 to 10.75
Pipes and flues	10.00 to 10.50
Railroad sheet and tank scrap	9.00 to 9.50
Railroad grate bars	9.25 to 9.75
Machine shop turnings	9.50 to 10.00

Birmingham

BIRMINGHAM, ALA., Feb. 28, 1916.

Pig Iron.—While furnaces in Tennessee and extreme northern Alabama, owing to the opening of barge lines to Brookport, Paducah and Metropolis, which still further reduce the freight rates that were already in their favor by the all-rail routes, can afford to undersell Birmingham iron, and are doubtless doing so, the Birmingham operators apparently have no difficulty in maintaining a minimum of $15 for first half and $15.50 for second half, with 50c. above these prices paid in some instances. The Sloss-Sheffield Company moved 1000 tons via barge line to Wisconsin points, St. Louis and Chicago territory around Feb. 20 to 23 at 75c. to $1.25 per ton under the all-rail rate, and the iron traveled the 300 miles between Florence, Ala., and Paducah, Ky., in 40 hr. as compared with a usual rail haul of several days. This week 1500 tons additional will go the same route. The Chattanooga furnace engaged in the same traffic is making weekly barge shipments across Alabama, past the Florence and Sheffield furnaces and reaching St. Louis on a rate of $1.88 per ton as compared with the all-rail charge of $3.25, and is reaching Chicago on a rate of $2.48 per ton as compared with the all-rail rate of $3.75. There is an annual output of 250,000 tons of northern Alabama and Chattanooga iron available for this traffic, with no interruption at Sheffield and little at Chattanooga and Florence. Returning packets bring grain cargoes southward. Some northern Alabama and some Birmingham warrant iron has been offered under $14.50, a sale of 2000 tons having been made into Chicago territory at $14.25, it is reported, and, as above stated, Chattanooga and northern Alabama metal may as well hereafter be considered as selling when necessary to get the business at lower prices than Birmingham. There is little warrant iron now available. On the other hand, on Friday of last week a large foundry-iron maker booked 1000 tons for second half delivery in the Middle West at $16 and on the same day booked another order for 1000 tons for second quarter at $15. The same foundry producer sold during the week 1000 tons for last half at $16, 800 tons for the second quarter at $15 and five lots at $15.50 and $16, respectively, for second half. The leading interest quotes $15 and $16 for first and second halves, with very little business booking for the last named period. Local consumption is at a maximum. The Woodward Iron Company has bookings of basic metal for second half delivery sufficient to warrant operating a stack on basic during that period. This is reported to have been done on a $15.50 basis. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft	$15.50 to $16.00
No. 2 foundry and soft	15.00 to 15.50
No. 3 foundry	14.50 to 15.00
No. 4 foundry	14.25 to 14.75
Gray forge	14.00 to 14.50
Basic	15.00 to 15.50
Charcoal	22.50 to 23.00

Cast-Iron Pipe.—Prices are firm, with an upward tendency. In some instances $28 per ton is realized for small sizes, while the differential of $3 between 4 in. and 6 in. and larger is becoming fixed. Municipal inquiries have increased and bookings are sufficient to maintain operations. Anniston sanitary pipe makers are having labor troubles which have militated against their output. The American Cast Iron Pipe Company has approached the Government in regard to the merchant marine, stating that it would seriously consider purchasing and operating its own ships between this country and South America. J. R. McWane, president of the company, is still in South America for trade extension purposes. Small shipments of sanitary pipe are being made thither. We quote, per net ton, f.o.b. pipe shop yards, as follows: 4 in., $27; 6 in. and upward, $24, with $1 added for gas pipe and 16-ft. lengths.

Coal and Coke—The only thing the matter with coke is scarcity of cars for far-off movement, such as Texas and Mexico. The 300 Bessemer beehive ovens of the Tennesee Coal, Iron & Railroad Company and the 1000 of the Woodward Iron Company will be ready to resume in the immediate future, but their output will go into company operation. Yolande foundry coke continues to rule at $4 per net ton at oven, and Brookwood and other makes at $3.75, and there are no accumulations. Whiteman Brothers, New Orleans, ship handlers, have taken over the movement of Pratt Consolidated coal via Warrior River to New Orleans and other Gulf ports, starting with a fleet of twenty river barges and three towboats and five ocean-going barges with ocean-going tugs. The Tennessee Company is arranging to make similar shipments in addition to its self-propelling coastwise barge traffic to New Orleans. The coal trade at large is not up to standard.

Old Material.—Consumers appear to have filled up on immediate wants, with a resultant dampening effect on the scrap market and lower prices. The setback is regarded as temporary, however, stocks not being large. A small buying movement would restore conditions. We quote, per gross ton, f.o.b. dealers' yards, as follows:

Old iron axles	$13.00 to $13.50
Old steel axles	13.00 to 13.50
No. 1 railroad wrought	10.50 to 11.00
No. 2 railroad wrought	9.00 to 9.50
No. 1 country wrought	9.00 to 9.50
No. 1 machinery cast	10.00 to 10.50
No. 1 steel scrap	10.00 to 10.25
Tram carwheels	10.00 to 10.25
Stove plate	8.50 to 9.00

The Brown Schefrin Company, Milwaukee, Wis., has been incorporated with a capital stock of $20,000 to deal in old material. The incorporators are R. E. Locher, Samuel Schefrin and Lee F. Saltzstein, attorney.

San Francisco

SAN FRANCISCO, CAL., Feb. 21, 1916.

A week of fair weather has brought out a much more general demand, with more activity in the small country trade than for many months. Large inquiries for special work also continue numerous, with more attention given to material used in building. Merchants and large consumers are now seeking to cover requirements as far as possible for the remainder of the year. Local stocks are getting badly broken. Foreign contracts are still absorbing a large tonnage, and there are indications of increasing demand from the Orient. Exceptionally active jobbing trade is reported in southern California.

Bars.—The movement from stock has been quite heavy in the last fortnight, and several merchants are placing good-sized orders with local mills, in addition to specifying their full tonnage on old contracts in the East. The local plants still have considerable export tonnage, and find increasing difficulty in making early delivery on all sizes. There is talk of further increases to Pacific coast rolling capacity, beyond those already announced. Inquiries are expected shortly for several large lots of reinforcing material. Jobbing prices, based on the Eastern market, have been marked up to 3.60c., while the local mills are getting about 2.75c.

Structural Material.—Nothing of great importance has yet appeared, but many small jobs are coming out, and most local fabricators are now fairly well occupied. The Ralston Iron Works has about 150 tons for an apartment house on Eddy Street. The California Steel Company has taken about 200 tons for an addition to the Fife Building, Market and Drumm streets; small contracts for the Leventritt Building on Mission Street and a soap factory in Oakland; and a building for the American Can Company at Los Angeles. Plans have been started for the new Southern Pacific office building of about ten stories, to cover a large area at Market and Spear streets, and it is reported that work will soon be started on the Pacific Electric Railway shops at Torrance, Cal. While a fair tonnage of plain material is arriving on old contracts, some sizes are very short, and there is considerable trading between shops in the effort to keep the required assortments.

Plates.—The principal oil refinery and tank construction under way has been provided for, but there is still a great deal of business coming out on small scattered tank jobs, as well as for pipe work. The city of San Diego took bids Feb. 15 for 16,000 ft. of 35-in. pipe, but wood pipe was accepted on account of quick delivery. The city of Los Angeles has placed a contract with the Baker Iron Works for 3000 ft. of 54-in. pipe, requiring about 1500 tons of plates and blue annealed sheets. The boiler shop trade is increasingly active, and shipyards are buying practically all they can get, having nearly cleaned up local jobbing stocks of wide sizes, for which extreme prices were paid. It is reported that a Japanese steamer line is preparing to establish a shipyard and begin work as soon as possible on five 10,000-ton steamers.

Sheets.—Galvanized sheets are gradually picking up, but the heaviest call thus far has been for blue annealed, which are in exceptional demand for pipe, tank and miscellaneous construction. Few mills are taking any new business except for very distant delivery, and stocks on hand are light. The town of Colton, Cal., is in the market for 1500 ft. of 16-in., 12-gage, riveted pipe, and a large lot of fittings.

Wrought Pipe.—The last advance has stimulated buying considerably, on the part of both merchants and large consumers. Lap-weld pipe is in especially strong demand, particularly in the oil fields, where the outlook is very encouraging. While delivery on butt-weld sizes is still prompt, buyers have made liberal provision against a possible shortage, and further orders are expected, as there have been some heavy sales from stock for special purposes. The plumbing trade remains quiet, but will soon feel the effects of increased building activity.

Cast-Iron Pipe.—The past month's tonnage has been below expectations, but inquiries are beginning to come out in better shape. Los Angeles will take bids Feb. 25 for about 1600 tons of sizes up to 12 in., and San Rafael will take bids March 6 on a small lot. Salt Lake City is in the market for about 1000 tons. Prices are unchanged at $35 per net ton for 6 in. and over, $38 for 4 in., and $1 extra for class A and gas pipe.

Pig Iron.—Improvement in the foundry trade continues, and small melters and those that failed to make contracts are now coming actively into the market for their current supplies. A good many contracts are also being placed for second half. Local steel-making requirements are pretty well covered by contracts for Chinese iron, but deliveries are coming slowly, and with the increased capacity of the furnaces the supply from that source may run short. No. 1 Southern foundry iron is quoted at $27 per gross ton, for either current delivery or second half.

Coke.—Stocks of foreign coke, either in dealers' or consumers' hands, are now pretty completely exhausted, and sales of Southern coke have been fairly large, both on contract and for early shipment. Prices are very firm, popular brands bringing $16 to $17 per net ton.

Old Material.—The large consumption of steel scrap has brought in large shipments from the interior as well as from such points as Honolulu, etc., and a good many accumulations have been cleaned up. There is said to be still plenty in the country, but the more readily available lots are firmly held, and prices now range as high as $13, and perhaps a shade higher, per gross ton, but with some kinds still selling as low as $8. Cast-iron scrap is quite plentiful, though there is a fair demand. Prices range from $12 to about $15 per net ton.

Ferroalloys.—Spot supplies of ferromanganese and ferrosilicon are not sufficient for current needs, and consumers are endeavoring to provide for the remainder of the year. Some good-sized contracts have been made, but offerings are small.

J. H. France, representing a New York manufacturer of furnace linings, is said to have placed contracts with parties at Porterville, Cal., for 20,000 tons of magnesite. About fifteen carloads of this material per day is now being shipped from Porterville.

New York

NEW YORK, March 1, 1916.

Pig Iron.—There has been more active selling by some of the Buffalo furnaces, particularly in basic iron to western New York interests. The foundry iron market is apparently firmer so far as Buffalo sellers are concerned, but there is no uniformity in prices and here and there furnaces that are going in or that have not been so heavily sold up as others are willing to shade recent asking prices 25c. or more. Two or three cases have come up in the last ten days in which the competition for orders was more active than would be expected under the known conditions of pig iron supply and demand. In the past week the General Electric Company has come into the market for 1500 tons of high silicon iron and for some special analysis iron. The Buffalo quotations on the high silicon have been $19 to $19.50 and yet a quotation on iron about equal to No. 1 for delivery in eastern New York is reported at the equivalent of $18.10 Buffalo. This is apparently exceptional. A manufacturer of hot air furnaces in New Jersey is negotiating for 1000 tons of foundry iron and another New Jersey interest is inquiring for 500 tons. The inquiries now up are mostly for the second half but some of them are for the second quarter. Some Virginia iron has been sold lately in New England at a concession. The embargo on iron originating with the Pennsylvania Railroad for shipment into New England, which was removed Feb. 22, was on again Feb. 25. The Norfolk & Western embargo at Norfolk, Va., against the Merchants & Miners Transportation Company is still effective. The Lehigh Valley and Lackawanna railroads removed their em-

bargo to New Haven railroad points on Feb. 18 and 19. New England malleable interests have been in the market for a considerable tonnage and may take as much as 20,000 tons for second half. Some sales of No. 2 X in New England have been at close to $20 delivered. Pig iron sellers in view of the increase in inquiry and the important transactions in steel-making pig iron in the middle West believe that the easier condition obtaining in some parts of the market in February will be succeeded by higher prices. In that connection a sale of 1000 tons of gray forge is noted at $19 at eastern Pennsylvania furnace and one of 5000 tons of basic at $19.50 at furnace. New England foundries have been feeling out the situation on coke with a view to placing contracts for delivery after July 1 and some of them desire to contract for a year. We quote at tidewater as follows for early delivery: No. 1 foundry, $20.25 to $20.75; No. 2 X, $19.75 to $20; No. 2 plain, $19.25 to $19.50; Southern iron at tidewater, $20 to $20.50 for No. 1 and $19.50 to $20 for No. 2 foundry and No. 2 soft.

Ferroalloys.—Estimates of the sales of British ferromanganese in February for last half delivery range from 15,000 to 20,000 tons. The price obtained on 2000 tons of this was $155, seaboard, the remainder selling at $150, seaboard, the present quotation; but in no case are deliveries guaranteed. Several thousand tons are still before the British producers for acceptance, but most representatives here have been told that no more is available at $150. If more is sold for last half delivery it is expected that the price will be advanced and a higher quotation is not unexpected. While the situation as to most consumers is not regarded critical some are hard pressed and one or two may have to shut down. Spot material has sold at $250, one lot of 5 tons which was available for resale in central New York State having been quickly absorbed at this price, f.o.b. Spiegeleisen, 19 to 21 per cent, is now quoted at $50, furnace, for forward delivery, but is hard to obtain. Spot material of 16 to 19 per cent grade has sold as high as $50, furnace. Spiegeleisen containing 25 to 30 per cent manganese has been bought at $3.50 per unit of manganese and some is held as high as $4 per unit at furnace. It is understood that a Western producer is making a 30 to 35 per cent spiegeleisen which has sold at $80 to $85 per ton, furnace. Ferrosilicon, 50 per cent, is in strong demand. The market is likely to be somewhat relieved in the near future by a new American producer and by the increased production of a large Canadian maker. Some consumers are very low in their supplies and one or two may be obliged to close unless their needs are met. Ferrotungsten is quoted at $8 to $10, New York, per pound of contained tungsten, but the market is very erratic. Ferrochromium, 60 to 70 per cent chromium, is quoted at 16c. to 20c., New York, per pound of contained chromium. Ferrovanadium is selling at $3 to $3.25, Pittsburgh, per pound of contained vanadium. Ferrotitanium, 15 per cent, is quoted at 8c. per pound, f.o.b. plant, for carload lots, 10c. per pound for ton lots and 12½c. per pound for small quantities.

Structural Material.—There is no denying that the rapid advance in late weeks of the price of plain material has resulted in the postponement of a number of projects of considerable size, but, on the other hand, the advancing tendency has driven in a considerable number of building projects for closure so that present options at lower prices than the going ones may be exercised. Over 10,000 tons in building work is likely to be settled within a week, largely to take advantage of just this condition. Contracts for specific jobs are being closed against designs not available for two or three months and one case is noted of 4000 tons on which prices are asked without any information being vouchsafed regarding either the location or owner. Until these jobs have been closed it will not be possible to gage the effect of the new plain material prices. Railroad bridge buying goes on apace, with a total which is satisfactory as compared with the volume of recent months. The largest awards for buildings include the following: American Express Company, 63 Broadway, 3500 tons, to the Hay Foundry & Iron Works; Baltimore Sheet & Tin Plate Company, Baltimore, 1800 tons, to the Riter-Conley Mfg. Company; office building at 509 Fifth Avenue for Leslie R. Palmer, 700 tons, to the Passaic Structural Steel Company; Samuel L. Moore & Sons Corporation, Elizabeth, N. J.; 500 tons for a foundry addition, to the Levering & Garrigues Company; Oakes Brothers building, Bloomfield, N. J., 250 tons to the Hedden Iron Construction Company; theater for Levy Brothers, Brookyn, 300 tons, to Harris Silvers Baker Company; Tremont Fireproof Storage & Refrigerating Company, 300 tons, to Hinkle Iron Company; Merchants Bank, Middletown, N. Y., 250 tons, to the American Bridge Company; professional building, Rochester, N. Y., 250 tons, to the Phoenix Bridge Company; Schiff apartment, Ninety-fourth Street, 500 tons, to the Empire Structural Steel Company, and the Lehigh Valley Railroad, Pier 44, East River, 600 tons, finally closed with the Levering & Garrigues Company. Some 3000 to 3500 tons for the Eaton Store, Winnipeg, Canada, will probably come to American steel mills. The railroad bridge contracts closed include 300 tons for the Baltimore & Ohio taken by the Pennsylvania Steel Company and about 200 tons for the New York Central taken by Lewis F. Shoemaker & Co. The structural work of immediate promise embraces 1500 tons for Bloomingdale Brothers, Fifty-ninth Street; 500 tons for an office building, Pearl Street, Brooklyn, for the Edison Electric Illuminating Company of Brooklyn; 900 tons for a loft building at East Sixteenth Street and Union Square; 500 tons for an apartment hotel on West Sixty-ninth Street; 450 tons for the Axelrod apartment; 1100 tons for the Third Presbyterian Church loft building, Newark, N. J., which was up for consideration some months ago; 300 tons for the Cushman stable, Amsterdam Avenue and Lawrence Street, and 250 tons for a garage at West End Avenue and Sixty-fourth Street. We quote mill shipments at 2.419c., New York, and buying out of store at 2.95c., New York.

Later.—The following awards have come to light: Korn loft, Fourth Avenue and Sixteenth Street, 875 tons, to the Hedden Iron Construction Company, and the following to Harris Silvers Baker Company, a total approaching 5500 tons for the week; Waite apartment, West Sixty-ninth Street, 475 tons; Wallace Estate loft, Fifty-fourth Street and Eleventh Avenue, 1100 tons; Hasco loft, East Thirty-second Street, 900 tons; Pinchot loft, West Sixty-fourth Street, 1900 tons; Girard loft, West Fortieth Street, 800 tons.

Steel Plates.—For emergency ship repair work, requiring delivery in days rather than weeks, 4c., Pittsburgh basis, is quoted; for delivery in say, six weeks, 3.15c. to 3.25c., Pittsburgh, is the common price; for delivery in second quarter, 3c., Pittsburgh, may possibly be done, while for the remainder of the year, provided the offering passes favorably the critical analysis of the maker, quotations range from 2.35c. to 3.25c. Substitutes for built-up columns and girders are receiving more than usual consideration, such as special rolled structural sections or cast-iron columns. The continued demand is forcing prices upward, and for prompt plates we quote mill shipments at 3.319c., New York, and warehouse shipments at 3.50c.

Iron and Steel Bars.—Bar iron has again taken the price position which describes its independence of steel bars; in other words such is the demand that makers felt justified in marking iron up $3 per ton. Steel bars are nominally 2.419c. to 2.669c., New York, the earlier the delivery, the higher the price. Iron bars are now 2.569c., New York, and the New York warehouse price of iron and steel bars is 2.95c.

Cast-Iron Pipe.—The city of Boston opened bids on Monday for about 2500 tons. R. D. Wood & Co. were the low bidders. The Warren Foundry & Machine Company secured the award of 500 tons of 6 to 24 in. at Pittsfield, Mass. Atlantic City, N. J., will shortly be out with specifications for a considerable quantity of pipe for high pressure service. Private buying continues quite active. Buyers of pipe may not fully appreciate the fact that the price of pipe, in relation to cost of raw material and labor, is much lower than prices of other finished products. As foundries approach the point of having their order books well filled

for two or three months ahead, it would not be surprising to see quite a sharp advance. Carload lots of 6-in., class B and heavier, continue to be quoted at $29.50 per net ton, tidewater, New York, class A and gas pipe taking an extra of $1 per ton.

Old Material.—Dealers are greatly embarrassed by intermittent embargoes which not only check buying but seriously interfere with deliveries. Railroads lift embargoes for a day or two and then make them more strict than ever. Despite this annoying condition of affairs, some classes of scrap have been sold in fair quantities. Rolling-mill stock has been adversely affected and prices are soft, but steel scrap is well maintained, owing to better conditions at Pittsburgh and in the West. Brokers are paying about as follows to local dealers and producers, per gross ton, New York:

No. 1 heavy melting steel scrap	$14.00 to $14.50
Relaying rails	23.50
Rerolling rails	15.00 to 15.50
Iron car axles	25.00 to 25.50
Steel car axles	24.00 to 24.50
No. 1 railroad wrought	18.50 to 19.00
Wrought-iron track scrap	17.00 to 17.50
No. 1 yard wrought, long	15.50 to 16.00
No. 1 yard wrought, short	14.00 to 14.50
Light iron	6.50 to 6.75
Cast borings	8.50 to 8.75
Wrought turnings	7.50 to 7.75
Mixed borings and turnings	6.50 to 6.75
Wrought pipe	12.50 to 12.75
Old carwheels	14.00 to 14.50
Malleable case (railroad)	12.50 to 13.00

The foundry trade continues active. Prices are higher on No. 1 cast but easier on No. 2. Dealers' quotations to consumers of cast scrap are as follows, per gross ton, New York:

No. 1 cast (machinery)	$17.50 to $18.00
No. 2 cast (heavy)	15.50 to 16.00
Stove plate	12.00 to 12.50
Locomotive grate bars	12.00 to 12.50

British Market Unsettled

Manganese Ore Exports from India to America May Be Prohibited

(*By Cable.*)

LONDON, ENGLAND, March 1, 1916.

The Cleveland pig-iron market is unsettled owing to maximum price decisions. It is possible that pig-iron warrant stocks may be seized; there is a big home demand at the reduced price of 82s. 6d. Makers are quoting up to 92s. for export, but it is doubtful if shipment will be possible. Hematite pig iron is unaltered at 140s., and it is officially stated that Welsh steel supplies are to be reduced.

American open-hearth blooms are quoted at $55 c.i.f. Ferromanganese for forward shipment to America has brought £32 f.o.b. It is reported that exports of manganese ore from India to America may be temporarily prohibited. Quotations on some products are:

Tin plates, coke, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 27s. to 27s. 6d., compared with 25s. 6d. last week.

Cleveland pig-iron warrants, 83s. 3½d., against 85s. 9d., London, and 89s. 6d., Glasgow, last week.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £19 10s., against £19 last week.

Steel ship plates, Scotch, delivered local yards, £13 5s.

Steel rails, export, f.o.b. works port, £11.

Hematite pig iron, f.o.b. Tees, about 135s.

Sheet bars (Welsh) delivered at works in Swansea Valley, £12 5s.

Steel bars, export, f.o.b. Clyde, £17 5s., compared with the last quotation of £17.

Ferromanganese, f.o.b. $150.

Ferrosilicon, 50 per cent, c.i.f., £27.

Confusion as to Maximum Prices Unsettles the Entire Market—Billets Scarce

(*By Mail*)

LONDON, ENGLAND, Feb. 8, 1916.

All grades of pig iron are very strong, and it is difficult to secure in quantity, even for far forward delivery. The buoyant temper of the market has had a stimulating effect upon the general demand alongside of the growing shortage of supplies and transport difficulties. There is still much confusion as to the so-called maximum prices and the market seems quite unable to appraise accurately the government's policy of price control. Numerous categories have not yet come into the schedule; in others the fact that market quotations are considerably in advance of the maxima announced leaves traders puzzled. East coast and Scotch hematite, for instance, were to cost 122s. 6d. a ton at the furnaces, but consumers are obliged to fill their requirements at fully 20s. above that figure. As a consequence producers have withdrawn all their quotations and refuse to entertain new business at any price. The quotations for some of the Cleveland common irons are similarly at variance with the maxima recently declared. In South Staffordshire the negotiations with the ministry of munitions which are to determine the prices of pig iron are not yet concluded and the fixing of values for finished iron is in consequence proceeding slowly.

There has been little new business from domestic consumers, having no occasion to come into the market, but there is a steady demand from abroad and business has been put through at the enhanced prices. The position of semi-finished steel is virtually unchanged, but there is no sign of relief from the difficulty manufacturers are experiencing in covering their wants. Welsh bars are being done at £12 5s. for local delivery. Billets are very scarce and makers have next to nothing to sell for near months. The congestion in finished steel shows no signs of relaxing, hence the booking of new business is hampered, while the supply of skilled labor is causing anxiety. There is a continued big demand for structural steel.

Iron and Industrial Stocks

NEW YORK, March 1, 1916.

In the period covered since our last report prices of stocks have moved up or down according to the tenor of reports from Washington regarding the international situation. In some of the so-called war stocks sharp recessions occurred, but in the general iron and steel list the fluctuations were not so wide. The range of prices on active iron and industrial stocks from Wednesday of last week to Tuesday of this week was as follows:

Allis-Chal., com.	27	- 30½	
Allis-Chal., pref.	78	- 81	
Am. Can, com.	57¾	- 64	
Am. Can, pref.	110	-111¼	
Am. Car & Fdy., com.	65½	- 70¼	
Am. Car & Fdy., pref.	117¾	-118⅛	
Am. Loco., com.	65¾	-	
Am. Loco., pref.	101¾	-103	
Am. Stl. Fdries.	52	- 54½	
Bald. Loco., com.	100	-109⅝	
Bald. Loco., pref.	109	-109½	
Beth. Steel, com.	450	-475	
Case (J.I.), pref.		85	
Colorado Fuel	39¾	- 45	
Deere & Co., pref.		95	
Gen. Electric	166	-170	
Gt. No. Ore Cert.	41¼	- 45	
Int. Harv. of N. J., com.	108¾	-110½	
Int. Harv. of N. J., pref.	114	-114¼	
Int. Harv. Corp., com.	68¼	- 69	
Lackawanna Stl.	74	- 80½	
Nat. En. & Stm., com.	23	- 26	
Nat. En. & Stm., pref.	97	- 97½	
N. Y. Air Brake	138½	-144⅜	
Pitts. Steel, pref.	95	- 95½	
Pressed Stl., com.	51	- 55¾	
Pressed Stl. pref.		102	
Ry. Stl. Spring, com.	38½	- 40½	
Ry. Stl. Spring, pref.		98½	
Republic, com.	48½	- 52⅛	
Republic, pref.	110	-111½	
Sloss, com.	55	- 56	
Pipe, com.	16⅝	- 18	
U. S. Steel, com.	81½	- 84	
U. S. Steel, pref.	116⅛	-116⅞	
Va. I. C. & Coke	50	- 50⅛	
Westg. Electric	62½	- 66½	
Am. Rad., com.	395	-396	
Am. Rad., pref.		134	
Am. Ship, com.	38	- 39¾	
Am. Ship, pref.	84	- 85½	
Chic. Pneu. Tool	66	- 70	
Cambria Steel	80⅞	- 81	
Lake Sup. Corp.	10⅝	- 11⅝	
Pa. Steel, com.		70	
Pa. Steel, pref.	98⅝	- 98⅞	
Cruc. Steel, com.	70¾	- 80¾	
Cruc. Steel, pref.	111¾	-115⅝	
Harb-Walk. Refrac., com.	83	- 84	
Harb-Walk. Refrac., pref.	101	-102	
La Belle Iron, com.	50	- 50½	
La Belle Iron, pref.	127	-127½	
Am. Brit. Mfg., com.	23	- 26	
Can. Car & Fdy., com.	65	- 67	
Driggs-Seabury	136	-142	
Midvale Steel	62½	- 68	

Dividends

The Railway Steel Spring Company, regular quarterly, 1¾ per cent on the preferred stock, payable March 20.

The Continental Can Company, regular quarterly, 1¾ per cent on the preferred and 1¼ per cent on the common stock, payable April 1.

The Yale & Towne Mfg. Company, regular quarterly, 1¾ per cent, payable April 15.

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.; New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c.; Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30c.; Birmingham, Ala., 45c.; Pacific coast, 73.9c. on plates, structural shapes and sheets and 65c. on wrought pipe and boiler tubes. The foregoing rates to the Pacific coast are by rail. The rate via New York and the Panama Canal is 56.9c.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, ¼ in. thick and over, and zees 3 in. and over, 2.25c. to 2.50c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in., on one or both legs	.10
Angles, 3 in. on one or both legs less than ¼ in. thick, as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail)	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles	.30
Handrail tees	.75
Cutting to lengths, under 3 ft. to 2 ft. inclusive.	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive.	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Plates.—Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, 2.35c. to 2.75c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers:

Rectangular plates, tank steel or conforming to manufacturers' standard specifications for structural steel dated Feb. 6, 1903, or equivalent, ¼ in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft., are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in. thick on edge or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft. down to the weight of 3/16 in. take the price of 3/16 in.

Allowable overweight, whether plates are ordered to gage or weight to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras	Cents per lb.
Gages under ¼ in. to and including 3/16 in.	.10
Gages under 3/16 in. to and including No. 8	.15
Gages under No. 8 to and including No. 9	.25
Gages under No. 9 to and including No. 10	.30
Gages under No. 10 to and including No. 12	.40
Sketches (including straight taper plates), 3 ft. and over	.10
Complete circles, 3 ft. in diameter and over	.20
Boiler and flange steel	.10
"A. B. M. A." and ordinary firebox steel	.20
Still bottom steel	.30
Marine steel	.40
Locomotive firebox steel	.50
Widths over 100 in. up to 110 in., inclusive	.05
Widths over 110 in. up to 115 in., inclusive	.10
Widths over 115 in. up to 120 in., inclusive	.15
Widths over 120 in. up to 125 in., inclusive	.25
Widths over 125 in. up to 130 in., inclusive	.50
Widths over 130 in.	1.00
Cutting to lengths under 3 ft. to 2 ft., inclusive.	.25
Cutting to lengths under 2 ft. to 1 ft., inclusive.	.50
Cutting to lengths under 1 ft.	1.55

No charge for cutting rectangular plates to lengths 3 ft. and over.

Wire Rods.—Bessemer, open-hearth and chain rods, $50 to $55, nominally.

Wire Products.—Prices to jobbers, effective Feb. 29: Fence wire, Nos. 0 to 9, per 100 lb., terms 60 days or 2 per cent discount in 10 days, carload lots, annealed, $2.25; galvanized, $2.95. Galvanized barb wire and staples, $3.25; painted, $2.55. Wire nails, $2.40. Galvanized nails, 1 in. and longer, $2 advance over base price; shorter than 1 in., $2.50 advance over base price. Woven wire fencing, 61½ per cent off list for carloads, 60½ off for 1000-rod lots, 59½ off for less than 1000-rod lots.

The following table gives the price per 100 lb. to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Plain Wire, per 100 lb.

Nos.	0 to 9	10	11	12&12½	13	14	15	16
Annealed	$2.30	$2.35	$2.40	$2.45	$2.60	$2.70	$2.80	$2.90
Galvanized	3.20	3.25	3.30	3.35	3.40	3.55	3.90	4.00

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect from Feb. 29, 1916, on black and galvanized steel and iron pipe, all full weight:

Butt Weld

Steel: Inches	Black	Galv.	Iron: Inches	Black	Galv.
⅛, ¼ and ⅜	67	40½	⅛ and ¼	56	29
½	71	53½	⅜	57	30
¾ to 3	74	57½	½	61	40
			¾ to 1½	64	45
			2	63	44

Lap Weld

2	71	54½	1¼	48	29
2½ to 6	73	56½	1½	59	40
7 to 12	69	51½	2	60	42
13 and 14	58½	..	2½ to 4	62	45
15	56	..	4½ to 6	62	45
			7 to 12	60	43

Reamed and Drifted

1 to 3, butt	72	55½	1 to 1½, butt	62	43
2, lap	69	52½	2, butt	61	42
2½ to 6, lap	71	54½	1¼, lap	46	27
			1½, lap	57	38
			2, lap	58	40
			2½ to 4, lap	60	43

Butt Weld, extra strong, plain ends

⅛, ¼ and ⅜	63	46½	⅜	56	39
½	68	55½	½	61	47
¾ to 1½	72	59½	¾ to 1½	65	49
2 to 3	73	60½	2 and 2½	65	49

Lap Weld, extra strong, plain ends

2	69	54½	1½	59	43
2½ to 4	71	56½	2	62	45
4½ to 6	70	55½	2½ to 4	64	48
7 to 8	65	48½	4½ to 6	63	47
9 to 12	60	43½	7 to 8	56	40
			9 to 12	51	35

Butt Weld, double extra strong, plain ends

½	59	46½	½	48	33
¾ to 1½	62	49½	¾ to 1½	51	36
2 to 2½	64	51½	2 and 2½	52	37

Lap Weld, double extra strong, plain ends

2	60	47½	2	49	33
2½ to 4	62	49½	2½ to 4	51	38
4½ to 6	61	48½	4½ to 6	49	36
7 to 8	55	38½	7 to 8	42	26

To the large jobbing trade an additional 5 per cent is allowed over the above discounts.

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Sheets.—Makers' prices for mill shipment on sheets, of U. S. standard gage, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows, f.o.b. Pittsburgh, terms 30 days net, or 2 per cent cash discount in 10 days from date of invoice:

Blue Annealed Sheets

	Cents per lb.
Nos. 3 to 8	2.60 to 2.75
Nos. 9 to 10	2.65 to 2.80
Nos. 11 and 12	2.70 to 2.85
Nos. 13 and 14	2.75 to 2.90
Nos. 15 and 16	2.85 to 3.00

Above prices are for Bessemer stock. For open-hearth stock $2 per ton advance is charged.

Box Annealed Sheets, Cold Rolled

Nos. 17 to 21	2.40
Nos. 22 and 24	2.45
Nos. 25 and 26	2.50
No. 27	2.55
No. 28	2.60
No. 29	2.65
No. 30	2.75

Above prices are for Bessemer stock. For open-hearth stock $2 per ton advance is charged.

Galvanized Sheets of Black Sheet Gage

Nos. 10 and 11	3.75 to 4.00
No. 12	3.85 to 4.10
Nos. 13 and 14	3.85 to 4.10
Nos. 15 and 16	3.95 to 4.20
Nos. 17 to 21	4.10 to 4.35
Nos. 22 and 24	4.30 to 4.55
Nos. 25 and 26	4.45 to 4.70
No. 27	4.60 to 4.85
No. 28	4.75 to 5.00
No. 29	4.90 to 5.15

Above prices are for Bessemer stock. For open-hearth stock $2 per ton advance is charged.

Boiler Tubes.—Discounts on less than carloads, f.o.b. Pittsburgh, freight to destination added, from Feb. 29, 1916, are as follows:

Lap Welded Steel		*Standard Charcoal Iron*	
1½ in.	42	1½ in.	37 to 38
1¾ and 2 in.	54	1¾ and 2 in.	41 to 42
2¼ in.	51	2¼ in.	38 to 39
2½ and 2¾ in.	57	2½ and 2¾ in.	45 to 46
3 and 3¼ in.	62	3 and 3¼ in.	49 to 50
3½ to 4½ in.	63	3½ to 4½ in.	51 to 52
5 and 6 in.	56	5 and 6 in.	45 to 46
7 to 13 in.	53		

Locomotive and steamship special charcoal grades bring higher prices.

1¾ in., over 18 ft., and not exceeding 22 ft., 10 per cent net extra.

2 in. and larger, over 22 ft., 10 per cent net extra.

Metal Markets

The Week's Prices

Cents Per Pound for Early Delivery

	Copper, New York		Tin,	Lead		Spelter	
		Electro-	New	New	St.	New	St.
Feb.	Lake	lytic	York	York	Louis	York	Louis
23	27.37½	27.25	42.75	6.30	6.30	21.25	21.00
24	27.37½	27.12½	43.12½	6.30	6.30	21.25	21.00
25	27.37½	27.12½	45.00	6.30	6.30	21.25	21.00
26	27.37½	27.12½	.....	6.30	6.30	21.00	20.75
28	27.37½	27.12½	50.00	6.30	6.30	20.75	20.50
29	27.37½	27.12½	48.00	6.30	6.30	20.75	20.50

NEW YORK, March 1, 1916.

Copper is considerably quieter and a little easier in price. Tin is several cents higher and sellers are few. Nearby lead is scarce; the leading interest appears to be anxious to restrain the market, while the independents are getting premiums for what they have to sell. Spelter is much less active and lower. Antimony continues firm at unchanged prices.

New York

Copper.—The market has turned very dull and the quotation for electrolytic is a trifle lower, although the underlying conditions are not much changed. The producers are so well sold ahead that they do not find it necessary to reduce prices. Spot electrolytic continues at about 28.50c., cash, New York. Lake is nominally at about the same level. Electrolytic for June and July is quoted at about 27.12½c., cash, New York. One of the surprising features of the situation is the quantity of copper which has come to light since the supposed scarcity developed, and which can be had at the slightly easier prices. The rush to buy ceased over a week ago with the beginning of a strike at the plant of the American Brass Company at Ansonia, Conn., and since then there has been a pronounced change in the market, although the strike is now over. The lull may be only temporary, and no one is attempting to predict that prices are fully started on the down grade. The change in quotations has been principally on nearby deliveries, futures easing but slightly. While the change occasioned surprise, it is really an old story, for when high prices falter offerings always become more frequent despite talk of insufficient supplies. It is reported that German interests, in the past few days, took 5,000,000 lb. for export shipment after the war on the basis of 26.50c., delivered in the last quarter at New York warehouse. The exports in February totaled 20,548 tons.

Copper Averages.—The average price of Lake copper for the month of February, based on daily quotations in THE IRON AGE, was 26.85c., and for electrolytic, 25.08c.

Tin.—Since the last report spot tin has touched 50c., but it cannot be learned that any sales were made at that price. On Wednesday last the market was firm but dull. On Thursday demand was lively, but there were few sellers because of uncertainty in the issuance of British shipping licenses which made brokers here feel insecure to such an extent that some of them were buyers instead of sellers. On Friday the market was less excited and between 350 and 400 tons changed hands. On Monday bids were made on the New York Metal Exchange of 50c. for spot, 45c. for March, 44c. for April and 43c. for May. These bids did not result in business, but they did force quotations up. Apparently the advance was too rapid for buyers and the day's sales were light. Yesterday was quiet again so far as actual sales went, although 38 tons was sold on the Exchange at 48c. There is a fair quantity of tin in this country, but it is being tightly held because of the fear of interruption to further arrivals. The deliveries into consumption in February were record breaking, amounting to 6388 tons, leaving at the end of the month 1308 tons in stock and landing.

Lead.—All prices are practically nominal. The leading interest is adhering to 6.30c., New York, but is restricting its sales. Independent producers are well sold up, but have taken some business at 6.50c., New York. Independents at St. Louis are quoting 6.30c. All the signs point to an effort on the part of the leading producer to hold the market down and prevent its running away. It will sell limited quantities to regular customers, but is turning down any unusual demand. Spot lead is actually scarce, and at the same time there is a fairly good domestic and foreign demand. Consumers would be willing to take metal to be delivered in the second quarter of next year, but sellers cannot be found even at the present high prices. The policy of the leading interest is not to sell so far ahead. The exports in February totaled 4749 tons.

Spelter.—The market has been dull since the last report, and though sustained to some extent by the meagerness of prompt offerings it has declined. The New York quotation yesterday was about 20.75c. and that at St. Louis, 20.50c., for prompt shipment in both cases. The situation in London is quite different, in that spot has advanced steadily and yesterday was quoted at £110, equal to about 23.50c., a price which has never been exceeded at London. Brass mill special at New York is about 22c. Nearby deliveries of any grade are declared to be none too plentiful, but it is a fact that there are now many new sellers of spelter who were unknown to the market a few months ago. The February exports totaled 2769 tons.

Antimony.—The market is dull and quotations are unchanged at 44c. to 44.50c., duty paid, for Chinese and Japanese grades.

Aluminum.—This metal is strong and from 61c. to 64c. has been bid. Sellers are very few. Sheet aluminum has been quoted at $1 per lb.

Old Metals.—The market is steady. Dealers' selling prices are unchanged as follows:

	Cents per lb.
Copper, heavy and crucible	25.00 to 26.00
Copper, heavy and wire	24.00 to 25.00
Copper, light and bottoms	20.00 to 21.00
Brass, heavy	15.00 to 15.50
Brass, light	12.50 to 13.00
Heavy machine composition	18.00 to 19.00
No. 1 yellow rod brass turnings	16.00 to 16.50
No. 1 red brass or composition turnings	16.00 to 17.00
Lead, heavy	5.75
Lead, tea	5.25
Zinc	14.00 to 15.00

Chicago

FEB. 28.—What is true of many other materials is true of copper, in that small quantities can be bought at better prices than large. For limited amounts it is understood that 27c. can be done for casting and 28c. for Lake. The metal market is lacking in steadiness and its course is difficult to anticipate. We quote: Casting copper, 27c. to 27.50c.; Lake copper, 28c. to 28.50c.; tin, carloads, 51c., and small lots, 53c.; lead, 6.35c.; spelter, 20½c.; sheet zinc, 25c.; Cookson's antimony, 50c.; other grades, 46c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 23½c.; copper bottoms, 21c.; copper clips, 22c.; red brass, 19.50c.; yellow brass, 15c.; lead pipe, 5½c.; zinc, 15c.; pewter, No. 1, 28c.; tinfoil, 35c.; block tin pipe, 38c.

St. Louis

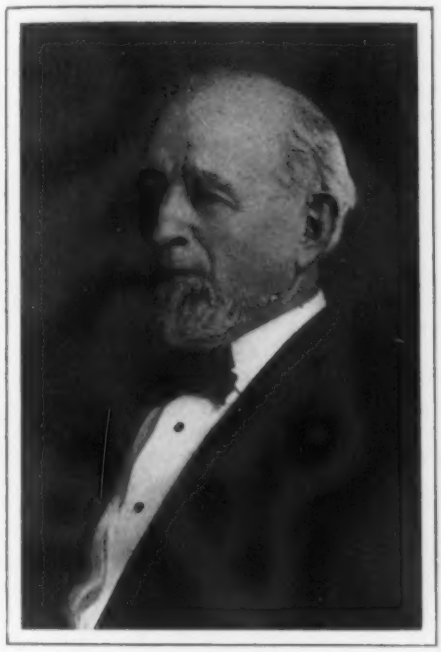
FEB. 28.—Non-ferrous metals have been sharply higher in the local market, with quotations to-day as follows: Lead, 6.50c.; spelter, 22c. for immediate delivery down to 19c. for April; tin, 53c.; Lake copper, 30c.; electrolytic copper, 29.50c.; Asiatic antimony, 48c. In the Joplin ore district, owing to smelters' indisposition to make heavy purchases, there was a drop of $10 per ton in the price of the choicest zinc blende to $120, with the range as low as $100 for second grade ores. The premium ores sold as high as $126 on settlement. Calamine sold at $85, basis of 40 per cent metal. Lead ore reached high water mark at $89, basis of 80 per cent metal. The average prices of all the production for the week were: Zinc blende, $105; calamine, $83; lead, $89. On miscellaneous scrap metals, buying prices are as follows: Light brass, 10c.; heavy yellow brass, 13c.; heavy red brass and light copper, 15c.; heavy copper and copper wire, 18c.; zinc, 10c.; lead, 5c.; tea lead, 3.50c.; pewter, 22c.; tinfoil, 32c.

"Tungsten" is the title of a booklet issued by Carlisle & Co., 74 Broadway, New York, for free distribution.

OBITUARY

Franklin Alter

Franklin Alter, president American Tool Works Company, Cincinnati, Ohio, died at his home in Avondale, suburb of that city, Feb. 27, aged 85 years. Up to two months previous to his death he had been actively at work. He was born in Carlisle, Pa., and went to Cincinnati when 19 years old, where he secured a position as clerk with the L. Booth Company, wholesale hardware. His business ability and energy were responsible for repeated promotions until he finally became vice-president of the company and later its sole owner. He next became interested in the shoe manufacturing business, forming the Alter-Julian Company, which factory is now operating under the name of the Julian-Kokenge Company. Subsequently he organized the Dunlap Shoe Company, and operated a large plant under that name. He entered the machine-tool business in 1900, when he purchased a controlling interest in the Davis & Eagan Machine Tool Company, changing the name to its present one of the American Tool Works Company.



FRANKLIN ALTER

Among the companies that Mr. Alter has served, either as an official or as a managing director, are the following: Farmers' and Shippers' Tobacco Company, Fay & Eagan Company, Cincinnati Motors Mfg. Company (builder of the Alter car) and Rockcastle Stone Company. In 1884 he was elected president of the Exchange National Bank of Cincinnati, and through his leadership that institution successfully weathered the financial storm of that year that forced many large banks to make assignments. At the time of his death he was a director of both the First National Bank and Union Savings Bank & Trust Company, both of Cincinnati. He was an active member of the Cincinnati Chamber of Commerce, Business Men's Club, Queen City Club and several other business and social organizations. He leaves his widow, four sons and three daughters. Robert S. Alter, one of his sons, is secretary and foreign manager of the American Tool Works Company, and another, L. W. Scott Alter, is a production expert with the company.

EDWARD I. LEIGHTON, formerly a prominent manufacturer of Cleveland, Ohio, died suddenly from pneumonia at St. Augustine, Fla., Feb. 19. He was born in England in 1850 and had lived in Cleveland nearly all his life. He was one of the founders of the firm of Leighton & Bauch, now the Cleveland Punch & Shear Works Company. At the time of his death he was identified with the Acme Machinery Company, Van Dorn & Dutton Company, Van Dorn & Dutton Electric Tool Company and Reliable Machine Company. He had been identified with various other Cleveland companies in metal-working lines. He retired from active business about 15 years ago. His son, Thomas E. Leighton, is purchasing agent of the Van Dorn & Dutton Company and Van Dorn Electric Tool Company.

JOHN MCILHENNY, once prominent as a gas engineer, died Feb. 23 at his home in Germantown, Pa., aged 85 years. He had been since 1876 a member of the firm of Helme & McIlhenny, 1339 Cherry Street, Philadelphia, manufacturer of meters and gas appliances. Until he resigned, a few years ago, he was president also of the American Meter Company, New York. Almost at the beginning of the manufacture of illuminating gas in the United States he was engaged as a constructing engineer for the firm of Perdicaris & Hoy, Philadelphia, and for them erected several gas plants in the South. He also operated the plant at Columbus, Ga., for several years, and while living there took an active part as mayor of the city, in restoring order and business after the close of the Civil War. He leaves two sons and three daughters.

FRANK THOMPSON, who was assistant general manager of the American Car & Foundry Company, Chicago, until ill health compelled his retirement last fall, died suddenly at Miami, Fla., Feb. 27. He was the inventor of a number of car appliances and came to the American Car & Foundry Company with the absorption of the Wells & French Company, of which he became the superintendent in 1890.

Cabled information was received in New York last week of the deaths of CHARLES CHURCHILL and his eldest son, CHARLES H. CHURCHILL of Charles Churchill & Co., Ltd., London, England. The company is one of the largest dealing in machine tools in England, and represents several American builders. It has offices in several English and Scotch cities.

GEORGE FISCHER, head of the Fischer Iron & Steel Company, Quincy, Ill., died suddenly from heart disease in his office Feb. 26, aged 60 years. In addition to his iron and steel interests he was vice-president of the Ricker National Bank and was otherwise in close connection with the business and public affairs of his city.

ALFRED D. WATERMAN, for the last 25 years connected with the Illinois Steel Company and the United States Steel Corporation, died on his way to California Feb. 22, aged 67 years. Since 1901 he has been a member of the staff of W. R. Walker, assistant to the president of the Steel Corporation.

CHARLES H. L'HOMMEDIEU, whose death at Louisville, Ky., was mentioned in THE IRON AGE of Feb. 17, was a traveling representative of the Cincinnati office of the Jones & Laughlin Steel Company and his age was 67 years.

HIRAM A. BRIDGES, secretary Sexton-Stubinger Range Company, St. Louis, Mo., died Feb. 22, aged 61 years. The company is one of the largest manufacturers of hotel equipment in the West. He leaves his widow and three sons.

CHARLES H. BRADLEY, JR., New England manager of the Erie City Iron Works, and a mechanical engineer, died Feb. 21 in Boston, Mass., after an operation for appendicitis, aged 44 years.

T. C. KENNEY, for some years manager of the foundry of Kenney & Co., Scottdale, Pa., died recently at his home in that city, aged 70 years.

ALFRED J. SILLS, Louisville, Ky., superintendent of the Ewald Iron Works, died last week after a long illness, aged 67 years.

The annual exhibit of evening work at Pratt Institute, Brooklyn, N. Y., where more than 1000 men, regularly employed in various vocations, are now taking courses in the School of Science and Technology, will occur on Wednesday evening, March 8.

PERSONAL

W. F. Roberts, who has been for several years general superintendent of the Bethlehem Steel Company, was elected a vice-president last week and given full charge of the operations of all steel plants, including those at Steelton and Sparrows Point of the recently acquired Pennsylvania Steel Company. Mr. Roberts is 36 years of age and his advance in the operating side of the steel industry has been rapid. He started at the age of 12 as an office boy for the late Eckley B. Coxe of Coxe Bros. & Co., in the anthracite region.

W. F. ROBERTS

He worked for six years in the office and technical library and attended the evening school of the Mining and Mechanical Institute which was fostered by Mr. Coxe. Thus he prepared himself for Lehigh University. At Lehigh he was a member of the honorary technical fraternity, Tau Beta Phi, and was also elected to Phi Beta Kappa. Graduating in June, 1902, from the mechanical engineering school of the university, he was employed by the Bethlehem Steel Company as assistant in the steam department and in the same year was given charge of that department. After five years in the steam, mechanical and construction departments, he was appointed master mechanic in 1907 with charge of all construction work. He was made assistant general superintendent in 1908 and in 1912 became superintendent of the Lehigh plant, later becoming general superintendent. He was elected a dirctor of the Bethlehem Steel Company in 1914 and on Feb. 19, 1916, became a vice-president.

H. E. Lewis has been elected a director of the Bethlehem Steel Company and has been appointed assistant to President Grace.

George Israel has been made manager of sales of the Central Steel Company, Massillon, Ohio, being promoted from the position of purchasing agent.

George B. Woolson has been elected treasurer of the Artillery Fuse Company, Wilmington, Del. He has been for the past twelve years purchasing agent and general office manager for the Wilmington Malleable Iron Works, Wilmington, a plant of the Eastern Malleable Iron Company, Naugatuck, Conn.

Wm. H. Donner, chairman of the Pennsylvania Steel Company, is quoted in newspapers to the effect that he will be associated with the Bethlehem interests, the new owners of that company, "as to such services as I may be able to render during this year."

John E. Anderson, for the past 24 years ventilating engineer and for seven years with the B. F. Sturtevant Company in its Chicago office, has been appointed sales manager by the Consolidated Engineering Company, Chicago, in charge of its Massachusetts blower department and Kinealy air washer.

Dr. F. W. Cunningham, Orange, N. J., has resigned his connection with the research and development work of the Newark plant of the General Electric Company to join the engineering research staff of the Powdered Coal Engineering & Equipment Company, Chicago, at which point he will be located after March 1.

J. M. Jones, who will sever his connection with the Central Steel Company, Massillon, Ohio, of which he is vice-president and general manager, to become president and general manager of the Baltimore Sheet & Tin Plate Company, Baltimore, Md., has been presented with a silver service by employees of the former company.

Thomas J. Moore, Jr., has been made acting manager of sales of the Philadelphia branch of the Halcomb Steel Company. He succeeds his father who died recently.

Henry W. Levengood, formerly employed by the Glasgow Iron Company, Pottstown Iron Company and Cambria Steel Company, in various plate-mill capacities, has been appointed superintendent of the plate mill of the Nagle Steel Company, Pottstown, Pa.

Frank H. Zimmers, for 25 years treasurer of the Union Foundry & Machine Company, Pittsburgh, which concern has liquidated, has been appointed general sales agent of the National Steel Casting Company, now building a new plant at New Cumberland, W. Va. Mr. Zimmers' headquarters will be in Pittsburgh.

C. S. White has been appointed purchasing agent of the Pittsburgh & Lake Erie Railroad at Pittsburgh, succeeding E. K. Conneely, promoted to the office of assistant to the vice-president at Pittsburgh.

David Carlin, Pittsburgh, has been appointed a deputy factory inspector in the Pennsylvania Department of Labor and Industry, specializing in foundry and boiler work.

Frank H. Pietsch has been appointed by the Packard Motor Car Company as manager of the truck department for the Chicago territory.

Frank G. Wallace of Pittsburgh, Pa., for many years a director of the Canadian Locomotive Company, Kingston, Canada, has accepted the position of managing director of that company, and William Casey, who has held the position of assistant general manager, has been promoted to manager.

J. G. Miller, for the past 11 years general sales agent of the Adrian Furnace Company and the Punxsutawney Furnace Company, has been admitted to partnership in the Boston and New York pig-iron firm of Reed, Fears & Miller. An office has been opened at DuBois, Pa., where Mr. Miller will make his headquarters, as heretofore.

F. E. Koehler has been appointed vice-president of the Racine Tool & Machine Company, Racine, Wis., assuming the active management of the business in the absence of J. M. Jones, who, while continuing as president of the company, has withdrawn from active participation.

Hon. E. N. Hurley, vice-chairman of the Federal Trade Commission, addressed the New York Trade Press Association Tuesday evening, Feb. 29, on the work of the commission and the plans it is developing in the interest of business security and better business methods.

Benjamin G. Fernald, 95 Liberty Street, New York, manager of the New York office of the Kerr Turbine Company, Wellsville, N. Y., has been elected a director and vice-president of the company.

W. F. McKenzie, who has been vice-president of the Gary Screw & Bolt Company, Chicago, for a number of years, has resigned from that company to become gen-

eral sales manager of the Buffalo Bolt Company, North Tonawanda, N. Y., with office at the company's plant at North Tonawanda.

W. Stuart Miller, iron and steel merchant of Manchester, England, is now in the United States in connection with steel purchases.

Charles F. Hauss, 16 Via Alberto da Giussano, Milan, Italy, president of the American Chamber of Commerce in Milan, sailed on Feb. 29 for Milan via England and France on the Nieuw Amsterdam. He has been in the United States since early in December to make connections with American manufacturers of pig iron, molding machinery, foundry equipment, etc.

Robert C. Barton, who has represented the Western Reserve Steel Company, Warren, Ohio, at its Chicago office, 122 South Michigan Avenue, has been appointed special representative, with headquarters at the mill and traveling in all parts of the country in the interest of the company's high grade sheets. He is succeeded at Chicago by George E. Thomas, formerly representing the Rank & Goodell Company at Minneapolis.

Fred Bush, manager of the Honolulu Iron Works, Honolulu, Hawaiian Islands, was a recent visitor in San Francisco.

The management of the Gary Screw & Bolt Company, Chicago, has been transferred to the Pittsburgh offices in charge of John P. Hoelzel and C. R. Ferguson, who have been appointed vice-presidents and will have supervision of sales and operations respectively. Philip Robinson will be the resident representative in charge of sales at the Chicago office, 122 South Michigan Avenue.

New England Iron and Steel Dinner

The twenty-third annual banquet of the New England Iron and Hardware Dealers' Association at the Hotel Somerset, Boston, Feb. 17, was made a notable event, 180 members and guests being in attendance. All the appointments of the occasion were exceptional, including the souvenirs, the scheme of decoration and the use of the National colors in a George Washington commemoration. At the speakers' table were Charles A. Adams, president of the association; Wilbur B. Ayer, vice-president; ex-President Charles F. Bragg; Toastmaster J. Franklin Babb; J. B. Bonner, Carnegie Steel Company; Col. H. P. Bope, vice-president Carnegie Steel Company; Hon. Channing Cox, Speaker of the Massachusetts House of Representatives; Hon. Richard W. Austin, member of Congress from Tennessee; John L. Haines, Jones & Laughlin Steel Company, Pittsburgh; Rev. Edward Cummings, Cambridge, Mass., and William C. Moreland, secretary Jones & Laughlin Steel Company.

President Adams opened the speech-making and was followed by Speaker Cox, Congressman Austin, John L. Haines and Colonel Bope. The trade aspects of the present situation were dealt with particularly by Mr. Haines and Colonel Bope—the present unparalleled conditions resulting from the large volume of war orders placed in the United States and some of the effects of the war that may be looked for in the iron and steel trades when peace comes.

The committee of arrangements for the dinner, which has come to be a noteworthy event in the New England steel and hardware manufacturing and jobbing trades, was headed by ex-President A. B. Marble, Boston, representative of the Jones & Laughlin Steel Company, and with him were associated R. M. Boutwell, Frank A. Marvin, Herbert Field, Charles A. Adams, E. E. Farnham, Wilbur Sargent Locke, Fred L. Avery, Fred L. Greely, George J. Mulhall, Leon C. Carter and W. B. Ayer.

Thomas Iron Company Improvements

A meeting of stockholders of the Thomas Iron Company will be held at Easton, Pa., March 11, 1916, to vote on the proposal to issue the remaining $400,000 of the $1,000,000 bond issue authorized on Feb. 26, 1914. The proceeds are to be devoted to improvements at the company's blast furnace and iron ore properties.

Pittsburgh and Nearby Districts

The new plant now being built by the National Steel Casting Company at New Cumberland, W. Va., will embrace a main brick foundry building, 60 x 340 ft., with a leanto, 30 x 340 ft., which will be equipped with a 40-ton electric traveling crane, a 15-ton acid open-hearth furnace, and the necessary core and annealing ovens. The company will make steel castings up to 20,000 lb. in weight. The plant will have excellent shipping facilities by which castings shipped out the morning of any day are promised delivery to customers in the Pittsburgh district the following day. The company is still in the market for some new equipment.

The Pittsburgh-Des Moines Company, recently incorporated under the laws of Pennsylvania with a capital stock of $300,000, will take over the operation of the Pennsylvania property of the Des Moines Bridge & Iron Works, located at Neville Island, Pittsburgh. This does not affect in any way the organization known as the Pittsburgh-Des Moines Steel Company, which is selling agent for the Pittsburgh-Des Moines Company and also for the Pittsburgh-Des Moines Bridge & Iron Works, which operates a structural steel plant at Des Moines, Iowa.

The Carnegie Steel Company, Pittsburgh, operates a private railroad from its Ohio works at Youngstown, Ohio, to the site near Niles, Ohio, on which the McDonald steel bar and hoop mills will be erected. At present a passenger train of four coaches is used to carry workmen from Youngstown to the new site.

The strike at the plant of the Republic Rubber Company, Youngstown, Ohio, which threatened to become serious, has been settled, and all who struck are back at work.

The Pittsburgh section of the Association of Iron and Steel Electrical Engineers held its regular monthly meeting at the Seventh Avenue Hotel, Pittsburgh, on Saturday evening, Feb. 19. Besides an address on accident prevention by L. R. Palmer, chief factory inspector of the Pennsylvania Department of Labor and Industry, Harrisburg, the past work of the association in regard to the safety movement was reviewed. W. T. Snyder, National Tube Company, McKeesport, Pa., president of the association, told how it was that at the sixth annual convention of the association in Milwaukee in 1912 the National Safety Council was brought into being, and that this organization now extends to all industries in the United States and represents nearly 10,000,000 workmen.

Early on Monday morning, Feb. 28, a part of the plant of Hubbard & Co., shovel manufacturer, Pittsburgh, was destroyed by fire. The loss is estimated at $125,000. The burned portion of the plant will be rebuilt as soon as possible.

The new hospital and new office building being erected by the Youngstown Sheet & Tube Company, Youngstown, Ohio, are nearly completed. The hospital is expected to be ready about March 1 and the office building about April 1.

The Sligo Iron & Steel Company, South Connellsville, Pa., is in the market for considerable foundry and rolling-mill equipment.

The Brier Hill Steel Company, Youngstown, Ohio, states that stockholders have subscribed about 95 per cent of the new issue of $2,800,000 common stock, authorized Jan. 25. The increased capital will be used to finance the construction of its new by-product coke plant of 84 Koppers ovens and a benzol plant now being built.

The Pike Coal & Coke Company, Pittsburgh, with a capital of $1,000,000, has been incorporated to acquire coal lands. The incorporators are William Boyd, W. I. N. Loft and George W. Morgan.

The McCormick Lumber & Supply Company, Pittsburgh, with a capital stock of $10,000, has been incorporated by George E. Evans, 197 Watson Boulevard, Pittsburgh; G. Bruckman, Bellevue, Pa., and J. F. McNaul, 822 North Euclid Avenue, Pittsburgh, to manufacture lumber and builders' supplies.

Machinery Markets and News of the Works

AUTO MAKERS BUY AHEAD

Lighter War Demand Induces Caution

Domestic Buying Steady and Hampered Only by Deliveries—Three Eastern Railroads Making Inquiry—Russians Are Buying

A feature of the present situation is the extent to which the automobile manufacturers have purchased machine tools for delivery in the latter part of this year, to be in readiness for their output of 1917 cars. In this connection it is noted that the Ford Motor Company has purchased special tools and equipment amounting to $1,500,000 in the past three or four weeks.

There are unmistakable signs that the war demand, especially for single-purpose machines, is fast on the wane, and makers are becoming more conservative in their production, despite the fact that they have protected themselves by the requirement of substantial deposits with orders. Prices appear to have reached the top-notch, although the advanced cost of materials and labor will keep the cost of production at a high level.

The demand for tools is quieter than it was, but there is a steady flow of demand, and more could be done were deliveries more to the liking of buyers. The export trade is lighter, although Russia continues a big buyer.

The Eddystone Munition Company, Eddystone, Pa., has its shell shop in operation and is employing about 2000 men. The cartridge case department is manufacturing and shipments will begin soon. Women and girls are employed in the fuse department of the company.

The John A. Roebling's Sons Company, Trenton, N. J., has purchased seven properties and has razed buildings, preparatory to extending its works. Actual work will be started in the summer.

The Pennsylvania, Philadelphia & Reading and the Baltimore & Ohio Railroads are in the market for tools.

The North Elizabeth plant of the Diehl Mfg. Company, Elizabeth, N. J., will turn out shells. It will be operated by Woodward & Co., who are associated with Gaston, Williams & Wigmore, New York, an exporting firm which has done a heavy war business. The Crocker-Wheeler Company, Ampere, N. J., is working on a new shell order.

Several building operations are reported from New England where the following firms have plant extensions under way: American Brass Company, Pratt & Whitney, George W. Prentiss & Co., and the Eagle Lock Company.

In Cleveland, the machine-tool market has quieted down, although there is a fairly active demand for early shipments. The automobile makers have bought heavily in that city for delivery next fall.

The States Motor Mfg. Company, Kalamazoo, Mich., has been incorporated with a capital stock of $600,000. It has acquired the former plant of the Michigan Buggy Company. The Bimmel Automobile Company, Sidney, Ohio, has incorporated with a capital stock of $500,000 and will take over the plant of the Bimmel Buggy Company for the manufacture of automobiles.

Cincinnati machine tool builders report some improvement in the domestic demand, also that labor troubles continue to embarrass certain shops.

Orders continue to appear without interruption in Milwaukee, but fewer are coming from foreign countries. The Laursen Automatic Pump Company, Eau Claire, Wis., maker of deep-well pumps, has purchased the plant of the former Globe Iron Works, Menomonie, Wis., and is preparing to place it in operation.

In western Texas the demand for mining equipment is good, and there is call throughout the State for oil prospecting apparatus.

In the Pacific Northwest machine tools for immediate delivery are not to be had, and the average shop is hesitating over buying for future deliveries.

The Elliott Bay Yacht & Engine Company, Seattle, announces that it will build a shipbuilding plant to cost $350,000.

New York

NEW YORK, March 1, 1916.

Several types of machine tools, especially single-purpose lathes, which have been in great demand for shell work, are more freely offered than they were a short time ago, and the impression is growing that the high tide of demand has been reached. Standard turret lathes, milling and grinding machines are still difficult to secure. Offerings of single-purpose machines have been freer for some weeks, but now certain manufacturers of standard machines can make reasonably early deliveries.

The situation is one which is causing some tool builders to display a conservative tendency with regard to production. The feeling of one builder of tools is expressed by his statement that this is pre-eminently a time for those connected with the industry to keep their heads cool and study out as far as possible what would be the normal condition of affairs if the war pressure were removed.

So far as prices are concerned it is generally believed that their crest has been reached, although the cost of materials promises to go higher, labor is scarce and wages high, and while these conditions last it is hardly likely that quotations will be lowered. The demand for labor exceeds the supply. This is evidenced by the "help wanted" advertisements appearing in the newspapers of manufacturing towns. Machine hands of every kind are eagerly sought.

Sellers handling a variety of machines report some irregularity in the demand, in that one day may be rather quiet, while the next activity is in full swing again. There is large domestic inquiry from buyers who want one or more turret screw machines, one of the larger inquiries coming from the Bethlehem Steel Company which wants fifteen machines.

Inquiries which have been put out by the railroads for miscellaneous railroad shop equipment indicate an awakening on their part. Both the Pennsylvania and Philadelphia & Reading Railroads are asking for quotations on lists of miscellaneous tools, and the Baltimore & Ohio, whose requirements were referred to a week ago, is contemplating a supplementary list.

Most of the buying for export is on Russian account, and some large deals have been closed in the past few days.

The Crocker-Wheeler Company, Ampere, N. J., which recently finished a shell contract, has purchased a few tools to facilitate the execution of a second contract of the same kind.

Gaston, Williams & Wigmore, 140 Broadway, New York, whose export business has expanded to such an extent that they have recently purchased several steamships, are also in

the manufacturing end. They are associated with interests at Thurlow, Pa., in the building of special machine tools, and have leased the North Elizabeth plant of the Diehl Mfg. Company, where shell parts will be manufactured under an arrangement with Woodward & Co.

Lockwood, Greene & Co., 101 Park Avenue, New York, are making preliminary studies for additional buildings for Gould & Eberhardt, Newark, N. J., but no plans are being drawn as yet.

It is reported that the Ironclad Mfg. Company, 929 Flushing Avenue, Brooklyn, N. Y., has had plans prepared by the Suffern Engineering Company, 149 Broadway, New York, for a three-story extension to its factory.

The recent fire loss to the Howe Rubber Company, New Brunswick, N. J., reported in the daily papers to be about $150,000, was considerably exaggerated. It will not exceed all told $30,000.

The American Saw Mill Machinery Company, Hackettstown, N. J., advanced the wages of its molders Feb. 15 from about 35c. to 40c. per hour.

The Diehl Mfg. Company, manufacturer of electrical apparatus, Elizabeth, N. J., leased its plant No. 2 about one month ago to Woodward & Co., Inc., recently incorporated in Delaware, which it is stated will use it for the manufacture of munitions and will later erect several buildings. The main reason why the Diehl company erected its Plant No. 2 was due to its inability at that time to obtain more buildings nearby its plant No. 1 at Elizabethport. Recently, however, it has been able to obtain additional buildings as required. Plant No. 1 has also been greatly enlarged. The leasing of plant No. 2 will, therefore, not affect its manufacturing in the least except to give it greater concentration, and the company is now putting out a more complete line of products than ever.

F. J. MacDonald has moved his business of building straw and dust blowers for threshing machines from Warnerville, N. Y., to Richmondville, N. Y., where he has leased an old foundry, which he is planning to put into operation. He desires to investigate the oxy-acetylene welding process for the steel drums of his blowers, and needs also a 1⅛ and a 2 3/16-in. adjustable reamer suitable for reaming housings for roller bearings.

The Consumers Ice Company, Hoboken, N. J., A. J. Volk, president, care of A. J. Volk Company, 670 Bergenline Avenue, West New York, N. J., contemplates the erection of an ice-manufacturing plant to cost about $200,000.

Walter Pfandler has completed plans for a storage building, 50 x 133 ft., to be erected on the north side of Plymouth Street, east of Washington Street, for the E. W. Bliss Company, 1 Adams Street, Brooklyn, N. Y., at a cost of about $10,000.

W. S. Barstow & Co., 50 Pine Street, New York City, are preparing plans for the erection of a one-story power plant, 50 x 90 ft., to be erected on Essex Street, Dover, N. J., for the Pennsylvania Utilities Company, 50 Pine Street, New York, at a cost of about $150,000.

Plans are being prepared for a two-story reinforced concrete machine shop and brass foundry, 60 x 176 ft., to be erected at 1112 North Avenue, for the Vitaphone Company, Plainfield, N. J. W. C. Simpson is purchasing agent and in charge. It will cost about $40,000.

It is reported the Pierce Motor Realty Corporation, care of Harrolds Motor Car Company, 233 West Fifty-fourth Street, New York, contemplates the erection of an annex to the automobile factory in the rear of Freeman and Webster avenues, Fifth to Sixth streets, Long Island City. Plans will be prepared by Griffin & Wynkoop, 30 Church Street, New York.

McGough & Hoey, 16 Court Street, Brooklyn, N. Y., have received the general contract to erect a one-story factory building, 80 x 93 ft. on Ditmas Avenue, East Eighty-third and East Eighty-fourth streets, Brooklyn, for the Beckers Aniline & Chemical Works at that address. It will cost about $8,000.

The William H. Connelly Company, 495 Twelfth Avenue, Newark, has received the general contract to erect a one-story forge shop, 50 x 100 ft., at 124 Coit Street, for the Irvington Mfg. Company, on premises. Frederick A. Phelps, Union Building, Newark, is the architect and engineer. The cost will be about $10,000.

The Ludlum Steam Pump Company, Watervliet, N. Y., is having plans prepared for a one-story shop, 100 x 600 ft., of steel and sheet iron, to be erected on Spring Road, town of Colonie, Watervliet. Edwin Corning is president.

Fred G. Peabody, Loudonville, N. Y., will erect a pumphouse at that place, from plans which are being prepared by Charles C. Grant, 37 West Twenty-eighth Street, New York City.

Henry W. Taylor, 100 State Street, Albany, construction engineer, is preparing plans for a water system, pumping and filtration plant for Wappingers Falls, N. Y.

The Buffalo Box Company, Buffalo, will build an extensive brick addition to its factory at Babcock Street and the Pennsylvania Railroad.

Philadelphia

PHILADELPHIA, PA., Feb. 28, 1916.

The scarcity of skilled labor in this section is continually brought to mind by various instances. In Lancaster it is estimated that 300 men have lately been induced to leave local employers by the offer of much higher wages at munition plants. It is estimated that about this number has left to enter the Eddystone Munition Company's plant and a great many have taken their families with them.

The Eddystone Munition Company, Eddystone, Pa., has its shell shop in operation and is employing about 2000 men; but this number will be largely increased. The cartridge case department is now manufacturing and shipments will probably take place before long. The opening of the fuse department is reported to be somewhat delayed by the non-arrival of some necessary equipment, but this delay is only temporary.

Textile machinery manufacturers have advanced prices within the last month from 10 to 15 per cent, due to the great increase in cost of materials. Dealers in second-hand textile machinery report that the demand for standard equipment is beyond anything ever known. Repair parts for these machines are in unprecedented demand for restoring fourth unit of five buildings. It will have about 120,000 sq. second-hand and abandoned machinery now needed for handling increased production in the textile mills. One New England textile machinery maker last week advanced prices 25 per cent over previous lists. Further advances by local manufacturers are likely.

The recent strike at the plant of the John A. Roebling's Sons Company, Trenton, N. J., has been settled and the works are now in full operation again.

Louis F. Shoemaker & Co., Pottstown, Pa., has granted a general increase in wages at its structural plant, now giving laborers $1.90 a day. The strike of die casters at the plant of the Light Cycle Company, Pottstown, was arbitrated and settled by both sides making some concessions.

It is reported that the plant of the International Forge Company, Pottstown, Pa., recently established, is delayed in starting operations by the failure of some of its machinery to arrive.

The Congoleum Company, department of the Barrett Mfg. Company, Marcus Hook, Pa., has broken ground for a fourth unit for its plant. It will have about 120,000 sq. ft. of floor space and cost approximately $250,000. It is to be completed in about seven months.

The plant of the Texas Company, Marcus Hook, Pa., is being improved by the addition of a new boiler house.

It is reported that about 65 per cent of the force of several hundred molders employed in the plants of the Carbon Steel Casting Company and the Hubley Mfg. Company, both of Lancaster, Pa., are now on strike.

William Steele & Sons Company, 1600 Arch Street, Philadelphia, has been awarded the contract for making various alterations to the machine shop of the George W. Blabon Company, Blabon Street and the Philadelphia & Reading Railroad, Philadelphia, at a cost of about $3,000.

The Baldwin Locomotive Works, Philadelphia, has awarded contract to the Armstrong & Latta Company, Land Title Building, Philadelphia, for the construction of a one-story brick machine shop at Pennsylvania Avenue and Twenty-sixth Street, to cost about $10,000.

The report that the Crane Company, 245 Master Street, Philadelphia, branch of the Crane Company, Chicago, is planning a factory to be erected in Camden, N. J., is without foundation. It is merely erecting a small warehouse for the convenience of its nearby customers.

The Hess-Bright Mfg. Company, Front Street and Erie Avenue, Philadelphia, is erecting a one-story addition, 40 x 150 ft., to its plant. Watson & Huckle, 1211 Walnut Street, Philadelphia, are the architects.

Ivar Alfsen, Ridley Park, Pa., is desirous of getting for a European house information concerning the complete installation required for the manufacture of files.

The Earle Gear & Machine Co., Philadelphia, Pa., is reported to have granted a 10 per cent increase in wages to about 125 of its employees.

The John A. Roebling's Sons Company, Trenton, N. J., has purchased seven properties on Clark Street and will raze the buildings to utilize the ground for an extension to its adjoining works, which was destroyed by fire a few months ago. No work, however, will be done on it until

summer, all of the company's efforts now being directed to completing the Buckthorn works, which is now very well along. All the buildings are completed and the installation of machinery has commenced. F. W. Roebling is secretary.

J. K. Petty & Co., Inc., owner of the Lebanon Boiler Works, Lebanon, Pa., at its annual meeting Feb. 14 elected John Petty of Lebanon, president and general manager; J. K. Petty, Philadelphia, secretary and treasurer, and W. K. Petty, of Philadelphia, vice-president. D. O. Mader, for many years president and general manager, and E. R. Mader, an important stockholder, both of Lebanon, have disposed of their interests to the new officers. The organization has undergone a change and the capacity and output of the plant have been greatly increased. Offices are maintained in New York and Philadelphia and a representative in Cuba.

The A. L. Miller Company, Conshohocken, Pa., manufacturer of lumber and mill work, is now putting in machinery to manufacture wood toy furniture on contract for Steinfeld Brothers, New York City. The probable output will be between 75,000 and 150,000 pieces per year. Additional equipment will be added as needed to produce this output. Warren Pepper is secretary and treasurer.

The Wicaco Screw & Machine Works, Inc., 625 Wood Street, Philadelphia, Pa., has had plans prepared by Herman Muller for the construction of a two-story brick and reinforced-concrete factory addition, 57 x 81 ft.

The Keystone Forging Company, Northumberland, Pa., advises that it does not contemplate the erection of a two-story forge shop addition to its plant, as has been reported.

The Stewart & Stevens Iron Works, 1716 North Ninth Street, Philadelphia, Pa., has purchased three properties nearby and is demolishing the buildings to provide space for an addition to its structural department, which will probably be about 45 x 60 ft. The company has been virtually swamped with business in the past four or five months. W. Nelson Mayhew and Samuel Frank are the proprietors.

T. J. Litzelman, architect, 149 West Fourth Street, Williamsport, Pa., is drawing plans for a one-story foundry to be erected in that city, the owner of which is as yet not named.

The Bicycle & Automobile Specialties Company, Philadelphia, has been incorporated by James W. McAuliffe, Narberth, Pa.; James Foster Smith, 1708 Mifflin Street, Philadelphia, and Frank W. Moffett, Rochester, N. Y., to manufacture bicycles, automobiles and motor accessories. The capital stock is $10,000.

The John Wood Mfg. Company, Conshohocken, Pa., has increased its stock from $50,000 to $500,000.

The Ertel Brothers Company, Williamsport, Pa., has been incorporated with a capital stock of $50,000 by Henry O. Ertel, Samuel Ertel and V. Albert L. Ertel, all of Williamsport, to manufacture boxes, pails and other specialties.

The Domestic Talking Machine Corporation, Philadelphia, Pa., has been incorporated with a capital stock of $200,000 by Wray C. Arnold, 121 North Twentieth Street, Philadelphia; Philip C. Arnold, 255 South Thirty-eighth Street, Philadelphia, and Joseph C. Brandt, Latrobe, Pa., to manufacture talking machines, records and phonograph supplies.

Baltimore

BALTIMORE, MD., Feb. 28, 1916.

Plans are being formulated by the Davison Chemical Company, Curtis Bay, Md., for the addition of a large plant to manufacture sulphuric acid.

Edward Baurenschmidt, 1528 North Gay Street, Baltimore, has filed plans for a one-story brick garage, 45 x 100 ft., at 1522 North Gay Street.

The Turbo-Gear Company, Baltimore, has been incorporated with $300,000 capital stock to manufacture mechanical devices. Curran W. Harvey, the Preston Apartments, Baltimore; J. Barton Harvey and Gustave Fast are the incorporators.

With $100,000 capital stock incorporation papers for the Universal Smoke Consuming Device Company, Baltimore, have been filed. The incorporators are John L. Matthew, George T. Reed, Edward H. Jordan and Michael A. M. McCormick.

To manufacture refrigerating and ice-making machinery the Chesapeake Engineering Company, Baltimore, has been incorporated with $100,000 capital stock by Philip G. Fredericks, Ezra H. Ford and William J. H. Culp.

William C. Scherer & Co., Inc., has been incorporated with $100,000 capital stock to build sawmills, etc. The incorporators are Hermann J. Hughes, 213 Courtland Street, Baltimore; William H. Hudgins and Joseph England.

A sawmill, 25 x 51 ft., will be built by the John Bancroft & Sons Company, Wilmington, Del.

It is understood the Pyrites Company, Ltd., will shortly begin the construction of a plant on a 77-acre tract at Wilmington, purchased from the Lobdell Car Wheel Company.

The Kurrle Packing Company, 29 Taylor Street, Baltimore, has awarded a contract to the Consolidated Engineering Company, Calvert Building, for a one-story brick addition to its packing plant, to cost $5,000.

Contract for an additional unit to the plant of the Shawinigan Electro Products Company, Highlandtown, Md., has been awarded the Guarantee Construction Company, New York City.

The Artillery Fuse Company, Wilmington, Del., is erecting a one-story building, 179 x 230 ft., to cost about $35,000.

New England

BOSTON, MASS., Feb. 28, 1916.

The Scovill Mfg. Company, Waterbury, Conn., has awarded a contract for the erection of a four-story building, 50 x 300 ft.

The Blakeslee Forging Company, Plantsville, Conn., is planning an addition to its forging department. Additional drop hammers and presses will be installed.

The Manomet Mills, New Bedford, Mass., is to build a mill to cost $1,000,000. It will employ about 1500 hands.

The Machiasport Ship Building Company, Machias, Me., has been organized with capital of $300,000.

The New Haven Carriage Company, New Haven, Conn., builder of automobile bodies, has begun the construction of an addition, 50 x 90 ft., two stories.

The American Brass Company, Waterbury, Conn., has secured permits for the foundations for two one-story buildings, 70 x 240 ft. and 92 x 162 ft.

The Pratt & Whitney Company, Hartford, Conn., is building an addition to its small tool department, 60 x 108 ft., four stories.

George W. Prentiss & Co., Holyoke, Mass., have awarded a contract for a five-story addition, which will be occupied by the Covered Wire Company, a subsidiary company.

The Eagle Lock Company, Terryville, Conn., has had plans drawn by the Samuel M. Green Company, Springfield, Mass., for an addition, 30 x 130 ft., one story.

Chicago

CHICAGO, ILL., Feb. 28, 1916.

Current possibilities for the sale of machinery include a large number of new and expanding industrial enterprises. The Hugo Mfg. Company, Duluth, Minn., concerning whose new factory buildings mention has already been made, advises that it will purchase a 10-ton and a 20-ton drawing press, a universal milling machine, a power squaring shear, an air compressor, an electric welding machine, an upright drilling machine, a riveting machine and electric motors for driving some of this equipment. The Ogren Motor Works, Inc., which has located at Waukegan, Ill., advises that it has begun the erection of its shops, which will cost $150,000. They will be ready for the installation of machine equipment in the early spring. Among the railroads the Western Pacific has a small list in the market and the Santa Fe is buying a few smithing tools.

The Chicago Mfg. & Welding Company has been organized with a capital of $10,000 by Walter H. Eckert, 10 South LaSalle Street, Warren B. Buckley and P. L. Nelson.

The Elgin Motor Car Corporation, 68 West Monroe Street, Chicago, has had plans prepared for a one-story factory, 168 x 272 ft., to be erected at Argo, a manufacturing suburb of Chicago, at a cost of $50,000. John A. Schroeder is chief engineer, and Davidson & Weiss are the architects.

Davidson & Weiss, architects, will receive bids for the construction of a plant to include foundry, pattern shop, machine shop and power house, the estimated cost of which will approximate $200,000.

The Lorenze Mfg. Company, Chicago, organized with a capital of $10,000 by A. Lorenze, and now located at 222 West Huron Street, will extend its line of manufactures under corporate form to include metal stands, furniture and novelties.

The Eureka Smokeless Furnace Company, Chicago, has been incorporated with a capital of $30,000 by Neils Buck, 105 South LaSalle Street, Herman T. Becker and M. J. Mears, to manufacture furnaces and boilers.

The Fort Dearborn Foundry Company, Chicago, has been formed by B. D. English, Charles E. Fargo and William Garnett, 140 South Dearborn Street.

The Central Bag Mfg. Company, 3622 Iron Street, Chicago, is building a four-story brick factory extension to its plant.

The Waterloo Boy Kerosene Tractor Company, Chicago, has filed application for charter with a capital of $10,000. The incorporators are Van N. Marker, B. Rudolph and A. D. Landphere, Mazonia, Ill.

The Sanitary Appliances Mfg. Company, Chicago, incorporated with a capital of $50,000, has been organized by Walter C. Krueger, 2024 North Keystone Avenue, M. S. Slesser and Sam Braness.

Leitter & Lamson, 4640 West Madison Street, Chicago, are building a one and two-story brick factory to cost $22,000.

C. E. Oxford, 220 South State Street, Chicago, is preparing to build a cement plant at Foreman, Ark., at a cost of $2,000,000. Construction is being delayed through inability to secure structural steel.

The Nicollet Sash & Door Company, Minneapolis, Minn., is building a small frame addition to its factory.

John Oswald, Minneapolis, Minn., is the organizer of a manufacturing company with a capital of $250,000, which will engage in the production of a mechanical automobile starter and will shortly erect a plant for that purpose.

The Consolidated Engineering Company, 507 West Jackson Boulevard, Chicago, Ill., has purchased the land, buildings, tools and machinery and equipment of the Massachusetts Fan Company, Watertown, Mass., and has commenced the manufacture at Watertown of the blower, fan and heater apparatus formerly made by the Massachusetts Company. The blower department contains 70,000 sq. ft. of land and about 50,000 sq. ft. of floor space. The Consolidated Engineering Company in addition to this is now erecting at Twenty-eighth Place and Shields Avenue, Chicago, a new factory 85 x 233 ft., which it is planned to have completed May 1.

Detroit

DETROIT, MICH., Feb. 28, 1916.

The Detroit Vapor Stove Company, Detroit, manufacturer of kerosene stoves, has acquired a site of five and a half acres in the Fairview district, and plans for the erection of a new plant are in the hands of the architects. Rapidly growing business has made an enlargement of the company's facilities imperative.

The Detroit Electrical Branding Iron Company, Detroit, has been incorporated by William Gutman, Joseph C. Garner and Benjamin B. Pelham to manufacture electric devices. It is capitalized at $50,000.

The Wayne Soap Company, Detroit, has awarded the contract for the erection of a four-story brick factory.

The Detroit-Wyandotte Truck Company, Wyandotte, Mich., will increase its facilities by the erection of an addition to its plant.

The Kalis-Haskel Company, Detroit, manufacturer of sheet metal stampings, tools, etc., has increased its capital stock from $40,000 to $100,000.

The States Motor Mfg. Company, Kalamazoo, Mich., has been incorporated with $600,000 capital stock to manufacture automobiles and motor trucks. It has acquired the former plant of the defunct Michigan Buggy Company.

The Walker Mfg. Company, Fenton, Mich., founder and machinist, will, it is reported, install additional machinery and add to its line of products.

The Buick Motor Company, Flint, Mich., is taking bids on the erection of a new heat-treating plant to cost about $9,000.

The plant of the International Mill & Timber Company, Bay City, Mich., manufacturer of knocked-down houses, was destroyed by fire Feb. 23, entailing a loss of $100,000. W. D. Young, president of the company, states that the plant will be rebuilt immediately.

The Howe Chain Company, organized at Muskegon, Mich., by Glen G. Howe and Ralph J. Tietor, secretary of the Standard Malleable Iron Company, has secured a plant in that city which it is remodeling and which will be placed in operation as soon as the difficulty of securing raw materials can be overcome. The company will have a capital of $100,000.

The Belknap Wagon Company, Grand Rapids, Mich., is remodeling its plant and will add to its equipment machinery suitable for the manufacture of automobile bodies.

The American Seating Company, Grand Rapids, Mich., will build an addition to its factory to cost $5,000.

Indianapolis

INDIANAPOLIS, IND., Feb. 28, 1916.

Carpenter Brothers, Anderson, Ind., formerly operating a tin shop, have moved to a new building where facilities are afforded for general sheet-metal work, including the manufacture of automobile fenders, hoods and tanks.

The Gary Foundry & Machine Company, Gary, Ind., organized with a capital of $15,000 by William H. Kleppinger, who is president and treasurer and was formerly president of the Preble Machine Company, has purchased a shop in that city which will be enlarged at once for the manufacture of brick-making machinery and general jobbing work.

The Indiana Public Elevator Company, Indianapolis, has been incorporated with $500,000 capital stock to build a grain elevator. The directors are W. H. Benedict, Paul R. Jones, F. M. Montgomery, Edward Doolittle and C. W. Bell.

The Indianapolis Cordage & Implement Company, Indianapolis, has been incorporated with $50,000 capital stock to manufacture binder twine. It has bought the plant formerly occupied by the American Motors Company, paying $70,000 for it. Samuel T. Murdock, Lafayette, Ind., is president, and Edward J. Fogarty, warden of the state prison at Michigan City, Ind., where there has been a large binder twine plant, will be general manager. Other directors are Charles M. and James G. Murdock and Albert B. Scheithe.

The Owen Mfg. Company, Indianapolis, has been incorporated with $15,000 to manufacture burial supplies. M. L. Owen, F. B. Kirkpatrick and F. L. Girard are the directors.

The American Valve & Tank Company, Indianapolis, has increased its capital stock from $50,000 to $100,000.

John J. A. McClurg, head of the Indiana Corrugating Company, Indianapolis, has purchased the Spring Steel Fence & Wire Company's plant at Anderson, Ind. It manufactures wire fence. W. S. Poling and G. J. Derthick, former owners, will manufacture automobile starters.

A building at West and Ohio streets, Indianapolis, formerly used by the Diamond Chain & Mfg. Company, has been purchased by the Duckwall Realty Company, and will be occupied by the Diamond Wire & Iron Works, the Duckwall Belting & Hose Company, and the Zenite Metal Company. The three corporations manufacture automobile specialties, and the capacity of each will be doubled in the new quarters. H. R. Duckwall is president of all three companies.

The Wells Mfg. Company, South Bend, Ind., has been incorporated with $25,000 capital stock to manufacture machinery and parts. The directors are Elmer E., C. Earl, E. Glenmore and Ralph D. Wells.

The Wernet Company, Muncie, Ind., has been incorporated with $10,000 capital stock to manufacture automobile parts. Norman L. Wernet, A. C. Lipsitz and Leo D. Pangborn are the directors.

The Holland Machine Company, South Bend, Ind., has changed its name to the Sibley Machine Company.

The Harwood-Barley Mfg. Company, Marion, Ind., has changed its name to the Indiana Truck Company.

The plant of the American Car & Foundry Company at Jeffersonville, Ind., has received a contract to build 400 army field ranges for the United States. Some contracts for steel passenger coaches and other equipment are held up as the steel cannot be obtained.

The Peabody School Furniture Company, North Manchester, Ind., has shipped 3000 school desks to Buenos Aires and has an order for 17,000 more. Last year the company shipped 12,000 desks to Brazil.

The Tuell Drawer Stop Company, New Albany, Ind., has been incorporated with $1,000 capital stock to manufacture drawer stop machines. The directors are G. D. and L. D. Todd and W. L. Tuell.

The Umphrey Mfg. Company, Crawfordsville, Ind., has been incorporated with $150,000 capital stock to manufacture furniture. The directors are Louis C. and William A. Umphrey and Charles L. Goodbar.

The Kramer Vacuum Brake Company, Anderson, Ind., has been incorporated with $25,000 capital stock to manufacture air brakes. Benjamin G. Kramer, N. M. McCullough and Fred E. Mustard are the directors.

The McIntosh Broom Company, Tipton, Ind., has awarded contract for a factory to cost $10,000.

The Savidge Steering Device Company, Indianapolis, manufacturer of automobile appliances, has changed its name to the Savidge Company.

The Hoosier Truck Company, Indianapolis, has been incorporated with $5,000 capital stock to manufacture automobiles, trucks and parts. The directors are Charles M. Powell, Reuben W. Estet and Otis Edgington.

Cleveland

CLEVELAND, OHIO, Feb. 28, 1916.

The local machine-tool market has quieted down, but the demand for machines for early shipment continues fairly active. Buying of machinery for delivery the latter part of the year has been very heavy, much of it coming from builders of automobiles, accessories and parts. Few inquiries for machines for extended future delivery are out. Manufacturers have apparently covered for future requirements to the extent that they have been able to anticipate their needs or have concluded that with present high prices and uncertain deliveries they will defer purchases. Cleveland machinery houses have taken considerable business from the Ford Motor Company for extensions to its Detroit plant. The purchase of special machine tools and tool room equipment by the Ford Company the past three or four weeks is estimated at $1,500,000.

The S. & M. Welding Company, Cleveland, has been incorporated with a capital stock of $40,000 by W. P. Lutzer, C. W. DeMooy, E. L. DeMooy, and others. It is located on East Fifty-fifth Street and is considering some plant extensions.

The Cleveland Metal Products Company, Cleveland, will erect an addition to its plant on Ivanhoe Road, to cost $20,000.

The Grasselli Chemical Company, Cleveland, has placed the contract for its new plant at Niles, Ohio, with William Kratzer & Co., Pittsburgh. It will include several one-story brick and steel buildings.

The Russ Company, Cleveland, manufacturer of soda fountains and other fixtures, will erect a one-story brick and concrete addition, 40 x 150 ft.

The Steel Products Company, Cleveland, has purchased several lots adjoining its plant and will erect an addition.

The Trolley Mfg. Company, Bowling Green, Ohio, has been incorporated with a capital stock of $10,000 by Roscoe E. Seever, Arthur G. Hale, Harvey A. Thrust, and others.

Cincinnati

CINCINNATI, OHIO, Feb. 28, 1916.

Makers of internal combustion engines are very busy on both large and small units. The larger units are sold in the natural gas belt, many manufacturers substituting gas engines for steam engines. The smaller sizes for gasoline are very much in demand in the rural districts and there is also a big demand for them from abroad.

The local machine-tool builders are almost unanimous in reporting some improvement in the domestic demand, but no change has occurred as far as the export trade is concerned. A few shops are still slightly handicapped on account of labor troubles, but most of the plants are operating with more than a normal force. At Hamilton and Dayton, Ohio, several foundries are still having labor troubles, but the different machinists' strikes in those cities have been adjusted.

The Foos Gas Engine Company, Springfield, Ohio, reports the receipt of an order from Russia for thirty 15-hp. engines, and also has other foreign business in sight.

Hamilton, Ohio, contemplates making an addition to its municipal lighting plant. A new boiler, engine and generator will probably be added to the present equipment.

The Thomas Mfg. Company, Dayton, Ohio, manufacturer of small lighting systems and automobile accessories, has leased a building adjoining its plant that will be fitted up for manufacturing purposes.

The Robbins & Myers Company, Springfield, Ohio, has commenced work on an addition to its plant, estimated to cost $150,000.

John Kellar, Columbus, Ohio, will establish a plant for the manufacture of mechanical toys. He may be addressed care the Columbus Chamber of Commerce.

Columbus, Ohio, has tentative plans under way for erecting a municipal ice-making plant.

The Solar Metal Products Company, Columbus, Ohio, maker of metal fire doors and other specialties, will add more equipment to its plant.

The proposed addition to the plant of the Lamneck Company, Columbus, Ohio, will be two stories, 40 x 100 ft., estimated to cost $30,000. The company does a roofing and heating contracting business.

The Bimmel Automobile Company, Sidney, Ohio, has been incorporated with $500,000 capital stock and will take over the plant of the Bimmel Buggy Company, which will be fitted up for the manufacture of automobiles. T. N. Miller is president and general manager.

The Ohio Fuel Supply Company, 52 West Gay Street, Columbus, Ohio, will erect a plant at Homer, Ohio, to extract gasoline from natural gas. Only special equipment will be required.

The Standard Lime & Stone Company, Millville, W. Va., is building a new crusher plant.

Milwaukee

MILWAUKEE, WIS., Feb. 28, 1916.

Machine-tool orders continue to come in without interruption. Bookings are practically all of domestic origin. The inquiry for export is gradually lessening, encouraging domestic purchasers to make their requirements known. Small-lot or single-tool orders are more frequent. Tool builders are able to gain on deliveries only slightly, but hope to remedy this by works extensions under way. Milwaukee jobbers in mechanics' tools and instruments complain at the inability of toolmakers to make deliveries. The demand for hand tools has been little short of extraordinary. Prices have been advanced all along the line but it is impossible to get certain instruments at any price.

The Time Mfg. Company, Oostburg, Wis., has been incorporated with a capital stock of $150,000 to manufacture an automobile to sell at $795. It has purchased the plant of the former Oostburg Foundry & Machine Company, Oostburg, and will start production April 1. Contracts are now being placed for parts for 1000 cars. The promoters are L. P. Timmer, Schleisingerville, Wis.; Frank A. Tuschen, and A. A. Grau, Milwaukee. An office has been established at 403 Caswell Block, Milwaukee.

The Aluminum Specialty Company, Sixth and York streets, Manitowoc, Wis., has awarded contracts for a reinforced concrete and steel addition, 40 x 60 ft., two stories and basement. E. W. Krug is president and manager.

The Lucia Brothers Motor Car Company, 218 North Adams Street, Green Bay, Wis., will erect a brick and steel addition, 40 x 80 ft., two stories. The architect is W. E. Reynolds, Green Bay.

The Erwin Mfg. Company, Milwaukee, Wis., has been incorporated with a capital stock of $25,000 to manufacture portable fire extinguishing devices for factories, garages, shops, etc. The incorporators are L. B. Erwin, O. R. Erwin and J. B. Erwin, 78 Loan & Trust Building, Milwaukee.

The Langlade Lumber Company, organized with a capital stock of $1,200,000 to take over the holdings of the Paine Lumber Company, Oshkosh, Wis., consisting of 55,000 acres in Langlade County, has selected a site of 80 acres in Antigo, Wis., for its proposed sawmill, to be ready Aug. 1. It will be a single-band type with horizontal resaw, slab resaw, with equipment for producing lath, shingles and railroad ties. A steam power plant and motor drive are specified. L. D. Mylrea, Wausau, Wis., is secretary.

The Home Made Shoe Company, Chippewa Falls, Wis., has increased its capital stock from $100,000 to $200,000 to provide for factory enlargement. Plans have not yet assumed definite shape.

Louis D. Fisher, head of L. D. Fisher & Co., 221 Muskego Avenue, Milwaukee, scrap iron, steel and other metals, has established a brass foundry at the same location under the name of the Fisher Brass Foundry Company.

A cold storage and warehouse plant will be erected at Algoma, Wis., by Reid, Murdock & Co., Chicago, Ill. Plans have been prepared for a brick structure, 50 x 84 ft., with an 80-ton refrigerating plant.

The Central Iron Works, Stevens Point, Wis., owned by R. A. Cook, is booking large orders for small trucks for factory and shop purposes from manufacturers throughout the Middle West and East. An order for 60 trucks was placed by the Automatic Cradle Mfg. Company, Stevens Point, which is preparing to build an addition. Mr. Cook is planning to add some equipment and later enlarge his shop.

The I. B. Rowell Company, Waukesha, Wis., manufacturer of agricultural implements and appliances, has increased its capital stock from $100,000 to $200,000, which will be devoted to enlargements and a general extension of business. Sam Breese, Jr., is president.

The Milwaukee Optical Mfg. Company, Stephenson Building, Milwaukee, has increased its capital stock from $40,000 to $100,000, and the business will be enlarged. It manufactures optical goods, lenses, workmen's goggles, etc. Charles Tribe is manager.

The Green Bay Avenue Garage Company, Milwaukee, Wis., has been incorporated by Otto A., Walter O., Alfred A., and Otto A. Ladwig, Jr. The capital stock is $25,000.

The Southern Wisconsin Light, Heat & Power Company, Lake Geneva, Wis., has been authorized to issue $20,000 of stock and $19,000 of bonds to purchase the United Light, Heat & Power Company, Delavan, Wis., from L. E. Meyers.

The Twin Washer Mfg. Company has been organized at Baldwin, Wis., with $25,000 capital stock, by Edward Christianson, Andrew B. Miller, Rasmus Johnson and Horace C. Nelson.

The Mutual Machinery Company, Fulton, Wis., has been organized with $7,500 capital stock by James R. Thomson, Albert Stark and George W. Stark.

The Wisconsin Aluminum Foundry Company, Manitowoc, Wis., is having plans prepared for a brick and steel, 75 x 145-ft. addition to its works at Sixteenth and Franklin streets for a casting and finishing shop. The capacity will practically be doubled. Bruno Dalwig is general manager.

The Laursen Automatic Pump Company, Eau Claire, Wis., manufacturer of deep-well pumps, has purchased the plant of the former Globe Iron Works, Menomonie, Wis., and will commence operations in the new location as soon as the buildings can be overhauled and additional equipment installed. The Globe plant has been held in trusteeship since it was turned over to the bondholders in 1913, and is equipped for the manufacture of gasoline engines, ensilage cutters and other agricultural implements. The Laursen Company is occupying leased quarters at Eau Claire and is so rushed with orders that enlargement was long ago deemed imperative. It is working on orders for pumps for delivery to Alaska, the Hawaiian Islands and other foreign countries. L. A. Laursen is president and superintendent; J. R. Meyers, vice-president and general manager; W. J. Eberwein, secretary, and A. T. Administer, treasurer.

Birmingham

BIRMINGHAM, ALA., Feb. 28, 1916.

Machinery supplies are in good demand. Portable electrical appliances, especially, are active. Mines and lumber mills are inquiring for engines, pumps and boilers. The tendency to install electrical apparatus is growing. Collections are fair and business is altogether good.

Announcement of plans for a $1,000,000 by-product plant on the part of the Sloss-Sheffield Company are expected not later than the annual meeting on March 15.

The Selma Packing Company, Selma, Ala., will be incorporated by R. H. Agee, Morgan Richards, Houston C. Armstrong, and others, and will build a meat-packing plant, to cost $200,000.

The Bradford Cotton Oil Company, Guntersville, Ala., has been incorporated with a capital stock of $25,000 by W. E. and Lula E. Bradford, and Carl L. Schisch.

The Argent Lumber Company, Savannah, Ga., has bought 8000 acres of shortleaf pine timber in South Carolina for $200,000 and, it is reported, will establish mills near Hardeeville, S. C. H. B. Phillips, Norfolk, Va., and J. W. Barnes & Son, Savannah, are among those behind the project.

F. M. Delk, Macon, Ga.; C. A. Benway, Chicago, and others, plan the establishment at Albany, Ga., of a factory to manufacture shovel handles.

The McDonough Compress Company, Atlanta, Ga., has been incorporated by W. H. Camp, N. B. Henry, and others, with a capital stock of $500,000.

The Carrabelle Iron Works & Supply Company, Carrabelle, Fla., will rebuild its plant, recently destroyed by fire.

Mark D. Williams, Middletown, N. Y.; A. M. Lowe, Tarpon Springs, Fla., and others, are organizing a company with a proposed capital stock of $100,000 to manufacture glass at Tarpon Springs.

The Pensacola Cooperage Company, Pensacola, Fla., has bought thirteen additional acres and will double the capacity of its plant.

The Tallassee Power Company, of which Arthur V. Davis, Bryson City, N. C., is manager, has plans for hydroelectric development on the Yadkin River for the Badin plant of the Southern Aluminum Company. The power company is incorporated with a capital stock of $1,000,000.

Texas

AUSTIN, TEX., Feb. 26, 1916.

No change of note occurred in the machinery and tool trade last week. Plans are being matured for extensive mining operations in the Terlingua quicksilver district of western Texas, and it is expected that a demand for considerable mining machinery will soon result from these activities. Oil prospecting operations are active throughout the State and the demand for rigs and equipment is unusually heavy.

The Black Hawk Mining & Milling Company will install a crude-oil engine, air compressor, drills and hoist at its mine 12 miles southwest of Silver City, N. M.

The San Marcos Gravel Company, San Marcos, has increased its capital stock from $10,000 to $30,000 and will add to its sand pit equipment.

The San Antonio Machine & Supply Company, San Antonio, has increased its capital stock from $300,000 to $450,000. It will enlarge and improve its shops.

The Trinity Tie & Lumber Company, Houston, has been organized with a capital stock of $40,000 to manufacture railroad crossties, etc. T. S. Quick is a stockholder.

The Stamford Motor Company, Stamford, will install an automobile repair shop.

The State Attorney General has approved two issues of city of Houston bonds, one of $1,500,000, the proceeds to be used for building municipal wharves and harbor improvements, and the other of $500,000, to be used for drainage works.

Kossuth Aycock, San Angelo, is erecting a garage and will install a machine repair shop, to cost in all $6,000.

The San Angelo Water, Light & Power Company, San Angelo, is having plans made for the construction of a central electric power station.

The Marion Ginning & Milling Company, Marion, organized with a capital stock of $11,000, will build a cotton gin.

The Sugarland Mfg. Company, Sugarland, has been organized with a capital stock of $300,000 to operate a sugar refining plant. G. D. Ulrich is a stockholder.

The electric light and machine shop owned by Thompson & Beitrich, Batson, recently destroyed by fire, will be rebuilt. The new plant will cost more than $50,000.

J. E. Quaid, El Paso, will install an oil pumping plant.

The Thornton Mill & Gin Company, Cameron, which has a capital stock of $15,000, will build a cotton gin and grist mill. L. B. Thornton is in charge.

The W. L. Moody Cotton Company, Galveston, has been organized to operate cotton compresses.

The Central South

LOUISVILLE, KY., Feb. 28, 1916.

The volume and tone of business in this section are more than satisfactory. Difficulty is noted in keeping up with orders, while there is some complaint of business lost because of inability to obtain steel. Inquiries are coming out in large numbers and orders booked for deliveries as late as December are not unusual. Prices are still soaring and some disposition is shown to postpone purchases until the market turns. A more active demand for ice machinery is reported, while motors and electrical tools are selling freely.

It is reported that the American Tobacco Company which will move its Middletown, Ohio, plant to Louisville, will install additional equipment to the factories at Eighteenth Street and Broadway and at Jackson and Jacob streets. Details have not been completed. J. C. Englehard, Louisville, is manager.

The Howard Shipyards, E. J. Howard, Jeffersonville, Ind., proprietor, has the contract for the construction of an Ohio River packet for trade between Paducah, Ky., and Elizabeth, Ill.

The Princeton Electric Light & Power Company, Princeton, Ky., has purchased the electric light and power franchise covering Caldwell County outside of the city.

The Sturgis Auto Sales Company, Sturgis, Ky., has been incorporated with an authorized capital of $15,000 and will equip a garage. T. E. Jenkins is president and Dr. J. O. McCauley secretary.

The Town Council of Mayfield, Ky., has passed a measure authorizing the city to issue bonds for the purchase of the Mayfield Water & Light Company.

W. S. Whiting, lumber operator of Asheville, N. C., has purchased 10,000 acres of coal and timber land in Morgan County, Ky., and will install a large band mill, construct six miles of railroad and otherwise develop the property. It is stated that the purchase price, for half the land outright and timber rights on the remainder, was $116,000 and that the purchaser will expend $185,000 in development.

J. L. Harpole has sold the Hopkinsville Machine Company equipment at Hopkinsville, Ky., to Rumely & Wachs, Chicago, Ill., who are dismantling it preparatory to removing it to Chicago.

The North American Fluorspar & Lead Corporation, operating near Smithland, Ky., is replacing its old and inadequate machinery with new. According to A. Tallaise of the mining company operations will be conducted on an expanding scale.

The City Council of Columbus, Ind., has decided to build a new electric light plant at a cost up to $20,000. It intends to enter the commercial lighting field.

Noel & Co., Nashville, Tenn., are to build a seven-story addition to their ice and cold-storage plant.

The Kentucky Light & Power Company, Fulton, Ky., has been incorporated with $250,000 capital by O. LeNeve Foster, C. M. Goheen and E. S. Hodgman.

Dorris Brothers, Gallatin, Tenn., have bought the old Trammel spoke factory, and, it is reported, will reconstruct and re-equip it as a planing mill.

The Southern Auto & Supply Company, Chattanooga, Tenn., projects construction of a three-story fireproof garage at a cost of $16,000. W. H. Sears, Chattanooga, is the architect.

J. N. Gladish, Pulaski, Tenn., has the contract for construction of a garage at that place for Walter A. Roberts, Nashville, Tenn., to cost $3,500.

The Rockwood Machinery Company, Rockwood, Tenn., proposes an addition to its plant, equipping it for the manufacture of heavy foundry products. E. W. Morris, F. H. Clymer, and others, are stockholders.

Swift & Co., Chicago, are reported to be equipping a tanning extract plant at Bristom, Bristol, Tenn., and to have contracted for eighteen 17 x 18-ft. leeches and two leech casting machines. Charles E. Camden is Bristol manager.

The plant of the Nashville Spring & Mattress Company, Eighth Avenue and Harrison Street, Nashville, Tenn., has been heavily damaged by fire with about $15,000 loss. It is reported that the damage will be repaired.

The Hoshall Machinery Company, Bank of Commerce and Trust Building, Memphis, Tenn., is in the market for two 100-kw., 125-volt, direct current generators and for two 75-kw. direct current 250-volt generators, all direct-connected to engines.

The Tennessee Stave & Lumber Company, Harriman, Tenn., is in the market for an American Hoist & Derrick type combination derrick and ditching machine. It is also inquiring about overhead skidding and logging machinery.

Prices on heading jointers, Oram type turner, double planer, piping and blower and heading saw machinery are being asked by the Livingston Heading Company, Livingstone, Tenn., recently incorporated with $10,000 capital. It will equip a building for an output of 1500 sets of tight barrel circled heading daily. E. M. Copeland is president.

Ruskin Cave College, Ruskin, Tenn., is asking for prices on a 40-hp. engine and 25-kw. generator, with other supplies for a steam power plant to replace one recently burned. The cost of re-equipping will be about $25,000. R. J. Kelly is in charge.

The Boaz Mfg. Company, maker of coal, gas and electric heaters, as well as excavating machinery, is reported to propose removal from Hamilton, Ohio, to Chattanooga, Tenn., where a new plant will be established. Present machinery will be removed to Chattanooga; but more will be purchased.

The Thompson Mfg. Company, manufacturer of machinery, has incorporated in Memphis, Tenn., with $5,000 capital. The incorporators are William H. Thompson, Alfred D. Mason, George H. Russell, Harry H. Magnum and S. F. Teter.

The Febiger Automatic Arms Mfg. Company, Pittsburgh, Pa., is reported to be negotiating with Owensboro, Ky., interests with a view to removal of its plant from Pennsylvania to the Kentucky city.

Construction of an ice and cold storage plant in Knoxville, Tenn., is announced by B. W. Baker, Atlanta, Ga., president of the Atlantic Ice & Coal Corporation, operating similar plants in 16 other Southern cities. The plant will stand at Jackson Avenue and Lanier Street, and will be erected at a cost of $100,000. An artesian well will be sunk and all ice will be made from distilled water. O. W. Deyerle, Atlanta, chief engineer of the company, is working out the plans.

St. Louis

ST. LOUIS, Mo., Feb. 28, 1916.

Machine-tool demand, while still as hard to satisfy, has settled down to a more steady flow. The call for equipment now covers quite all fields of industry, and the general condition of manufacturing hereabouts is of the healthiest. The needs of local manufacturers are for mostly domestic production. Money continues easy, both on loan and for investment. Collections are good and business conditions are on a very satisfactory basis.

The Franklin Automobile & Supply Company, St. Louis, Mo., has been incorporated with a capital stock of $15,000 by Sebastian Klein, George Gruenwald and M. Klein.

The Gas Engine Efficiency Company, St. Louis, Mo., has purchased the plant of the Shiras Electric Company, recently bankrupted, and will re-equip it for the manufacture of its own product, its present plant having been outgrown.

The Remmert Vacuum Cleaner Company, St. Louis, Mo., has been incorporated with a capital stock of $50,000 by Albert Marks, William Remmert and C. E. Scoles to manufacture vacuum cleaning apparatus.

The Wagner Electric Mfg. Company, St. Louis, Mo., has increased its capital stock from $1,800,000 to $2,000,000 and is enlarging its plant capacity by the equipment of a factory addition costing $100,000, aside from the machinery.

The St. Louis Frog & Switch Company, St. Louis, Mo., has contracted for a large addition to its plant.

The Louisiana Lumber & Cooperage Company, St. Louis, Mo., has been incorporated with a capital stock of $50,000 by C. A. Clark, B. K. Leach and John Fuhrer.

The St. Louis Independent Packing Company, St. Louis, Mo., will erect and equip a five-story packing plant, 170 x 200 ft.

The C. R. Cook Paint Company, 2107 Broadway, Kansas City, Mo., will build a six-story building, 100 x 300 ft., and equip it as a varnish factory.

The board of education of East St. Louis, Ill., will install an isolated electric light and power plant for three schools.

Richard Swartz, Hot Springs, Ark., is in the market for two generating units, driven by fuel oil engines, accessory equipment, etc.

S. D. Brookins, Monticello, Ark., will build and equip a natatorium. He is in the market for a gasoline engine pumping equipment.

The Dixie Broom Works, Hope, Ark., will equip a broom manufacturing plant and is in the market for equipment. S. J. Rogers is president.

The Roff Oil & Cotton Company's gin at Roff, Okla., has been burned with a loss of $15,000. It will be replaced.

The Chandler Electric Company, Chandler, Okla., will equip a plant for the development of about 200 hp. G. D. Henderson is manager.

F. H. Tathwell, Hennessey, Okla., will acquire the Hennessey Electric Power & Ice Company's plant and will erect an addition.

The Lightning Machinery Company, Oklahoma City, Okla., has been incorporated with a capital stock of $15,000 by Edward Goodwin and Samuel Pladger of Oklahoma City and H. H. Hinkle of Devol, Okla., and will equip a machine shop and foundry.

The White Eagle Gasoline Company, Ponca, Okla., has been incorporated with a capital stock of $50,000 by J. B. Hinkle, Carlos Combs, and others, including J. G. McCaskey, Pittsburgh, Pa., and will manufacture gasoline.

The Moon Gasoline Company, Tulsa, Okla., has been incorporated with a capital stock of $100,000 by Thomas Chestnut, T. K. Smith, C. P. Quinlan and E. J. Bowmaster, and will equip a gasoline distilling plant.

Edward MacTaggart and F. L. Bartlett of Tulsa, Okla., and G. M. Withington of Marietta, Ohio, have formed the Akins Gasoline Company, with a capital stock of $40,000 and will equip a plant.

The Cosden Oil & Gas Company, Tulsa, Okla., has been formed with a capital of $3,500,000 by J. S. Cosden, Tulsa, Okla.; E. R. Perry, Tulsa; Jacob France, R. Lancaster Williams, Eugene L. Norton, A. W. Gieske and Stuart Olivier, Baltimore, and will equip oil properties of 6000 bbl. output per day, increasing to 10,000 bbl. a day as rapidly as possible. It will operate in connection with the refinery and manufacturing plants of the Cosden Company.

W. H. Davis, Muskogee, Okla., has plans for the equipment of a plant for the manufacture of refrigerators.

The T. J. Spraggins & Sons Company, West Point, Miss., capitalized at $50,000, will equip a brick plant.

The Woodville Mfg. Works, Woodville, Miss., will equip a plant with 10 tons of ice-making and 5 tons of refrigerating capacity. R. E. Thompson, Wilson, La., is a stockholder.

The equipment of the Begg Mfg. Company, New Orleans, La., for manufacturing its band-saw crack preventer will be increased. Machinery will also be installed for the repair of general sawmill equipment.

The Superior Fire Clay Company, St. Louis, Mo., has been incorporated with a capital stock of $20,000 by Julian Simon, Jacob Leonhardt and D. J. O'Keefe, to manufacture fire clay products.

The Pacific Northwest

SEATTLE, WASH., Feb. 21, 1916.

Machine tools are necessarily quiet, as no tools of any consequence are in stock to offer. The average shop needing tools for present work finds little attraction in promises of delivery in six or eight months. Some fairly substantial orders are being placed, however, by some larger shops; and second-hand tools, if in passable shape, are eagerly snapped up. Lumber mills are busy repairing the damage done by the recent storm, and getting ready to operate. Many shops throughout the coast district are busy with repair work. Orders for new equipment also are fairly numerous, and a rush in the lumber industry is assured as soon as weather permits. The demand is increasing for miscellaneous factory equipment, especially for canning, creamery and cold-storage outfits. The spring movement to southern Alaska has started, and many shipments of mining machinery are going through to that region. Numerous inquiries are out for mine improvements in this vicinity.

An arrangement is being worked out between the Willamette Iron Works and the Northwest Steel Company, Portland, for the construction of a shipbuilding plant in the South Portland flats. It is stated that a contract for two large vessels is immediately available, if the project is carried out.

The Electric Steel Foundry Company, Twenty-fourth and York streets, Portland, is doubling its plant.

Neal C. Jamison, one of the largest shingle manufacturers of western Washington, has ordered plans for additions to his plant at Everett, Wash., which will give it a capacity of 2,000,000 shingles daily.

The port of Astoria commission, Astoria, Ore., has authorized its engineer to purchase coal-handling machinery for Pier 2, to cost about $40,000.

Machinery houses report that the past six weeks of inclement weather with the consequent closing of the mills has given them an opportunity to catch up on their orders for logging and mill equipment. The number of mills being built and the resumption of operations by practically every plant, even those closed for several years, has stimulated a great volume of inquiry for machinery. Machine tools are in good demand, with several substantial orders recently placed.

J. M. Leach, 47 Union Avenue, Portland, will move his machine shop to Yamhill Street and Union Avenue, where foundry equipment will be installed. It will also be equipped for general casting and shop work.

The Crescent Woodenware Company, Bonners Ferry, Idaho, whose plant was recently destroyed by fire, plans to rebuild it at an early date. R. Martin, Spokane, is president.

H. H. Yaste, Farmington, Wash., has purchased the machine shops and garage owned by the Farmington Land Company and will install some machinery.

The International Harvester Company, Spokane, Wash., will expend about $15,000 in improvements to its plant. A garage and motor repair shop will be installed. M. W. Weeks is the general agent.

The Inman-Poulsen Company's mill, foot of East Sherman Street, Portland, Ore., was practically destroyed by fire Feb. 17 with a loss estimated at $150,000. The work of rebuilding will begin as soon as the insurance adjustments have been made. This plant has a 10-hr. capacity of 360,000 ft.

It is reported that the manufacturing committee of the Citizens' Club, Chehalis, Wash., has closed arrangements with P. Gustavson, a foundryman of Chehalis, and John McLarty, for the establishment in Chehalis of a plant to manufacture motor trucks for use in shifting lumber on the docks at sawmills.

The Clarke County Iron Works, Vancouver, Wash., has filed a petition asking that the company be dissolved. It has removed its business to Portland, Ore., and will incorporate there.

The Elliott Bay Yacht & Engine Company, Seattle, Wash., has announced its intentions of constructing a shipbuilding plant in Seattle, to cost $250,000. It will include a floating drydock, 60 x 200 ft., a scow gridiron, six berths for ships under repair, machine shops, launching ways, etc.

Fire recently destroyed the roundhouse of the Polson Logging Company, Polson, Wash., with a loss of $20,000.

The Portland Pump Company, Portland, Ore., has increased its capital stock from $10,000 to $15,000.

The Willamette Iron Works, Portland, has taken a contract for six Scotch marine boilers for a Seattle shipbuilding plant.

The Hypotheek mine, Wallace, Idaho, will erect an ore mill of 150 tons or more capacity, and install an electric double-drum hoist. J. H. Kern is general manager.

The Carbon Hill Coal Company, Seattle, announces that its power plant, recently destroyed by a slide, will be rebuilt, steam power being replaced by electricity.

The Hercules Sandstone Company, Tenino, Wash., has purchased a site in Portland, on which it proposes to erect a factory for sawing and dressing building stone. It will also install new equipment at the quarries. H. P. Sheel is secretary.

The Oregon-Utah Sugar Company, Medford, Ore., has awarded to the Dyer Company, Cleveland, Ohio, contract for construction of its sugar plant to be erected in the Rogue River Valley, near Medford, at a cost of between $600,000 and $700,000. Alex Nibley is president of the sugar company.

Ernest R. Boyce, Billings, Mont., is promoting a packing plant in Billings, Mont. A company has been incorporated for $1,000,000 and it is stated work will begin soon on the plant, to include yards, refrigerators, water plant, storage houses, etc.

The Pine Box Company, Grants Pass., Ore., has re-opened its factory. A force of 52 men is employed.

The Colfax Mfg. Company, manufacturer of concrete mixers, sack pilers, etc., Colfax, Wash., has increased its capital stock from $10,000 to $25,000. D. W. A. Mitchell has been elected president. The new funds will probably be used to double the present plant and install machinery to triple the output.

The American Can Company, through Henry W. Phelps, vice-president, has announced its intention of establishing a plant in Seattle to cost $350,000. Negotiations for a site are now pending, and as soon as completed construction will begin. This will be the fifty-seventh branch plant of the company.

The Star Machinery Company, 1731 to 1741 First Avenue, Seattle, has taken over the complete line of contractor's hand hoists of the Sumner Iron Works, Seattle, including stock on hand.

The Montana Power Company, Helena, Mont., according to F. M. Kerr, general manager, will take immediate steps to carry out the project of constructing the Holter power plant and dam, about 30 miles from Helena. The project will cost between $3,000,000 and $5,000,000, and provides for a plant generating 6000 hp. Seven main hydraulic units, three exciter units and an auxiliary unit are provided for in the plans.

The marine supply company of Sunde & Erland, Seattle, Wash., have purchased the assets of the old supply house of Lewis, Anderson & Foard, Pier No. 1, and also the latter's Tacoma plant, in all for $80,000. The new owners will continue both businesses under the name of Sunde & Erland. It now covers the territory of the Pacific Northwest and Alaska.

Canada

TORONTO, Feb. 26, 1916.

The Imperial Munitions Board, Ottawa, has developed an organization for the business of the board. George Edwards, accountant, Toronto, will be auditor; Edward Fitzgerald of the Canadian Pacific Railway purchasing department, will have charge of purchases and contracts; Allan McAvity, Berlin, Ont., will supervise production; E. A. Schofield will control distribution; Captain Durley, engineer, Montreal, will have charge of the production and standardizing of gages; Bertram Leton, Toronto, will be adjuster between the various contractors, and F. W. Lamont, Toronto, will supervise all insurance. An office staff of 150 is maintained at Ottawa, and 2300 inspectors are distributed among the 454 firms engaged on the board's contracts.

The total trade of Canada for the 10 months ended with January was $989,359,000, compared with $714,465,000 in the corresponding period of the preceding year. Imports totaled $394,094,000 and exports $595,265,000.

The Canadian Pacific Railway Company, Montreal, will install a 50-ton electric crane at Burard Inlet, Vancouver, B. C.

D. Beaubien, 28 Royal Insurance Company Building, Montreal, is receiving bids for the installation of the following machinery at the plant of the Portneuf Hydro Electric Company, Portneuf, Que.: One 500-hp. hydroelectric unit; one vertical water wheel; one generator; one switchboard and general equipment.

D. Wilkie, Davidson, Sask., is asking for prices on garage equipment and accessories, air compressors, etc.

The Canadian Steel Specialty Company, Ltd., Grimsby, Ont., will shortly be formed with a capital stock of $100,000 to take over the former Hess plant at Grimsby. Harry Hess

will be superintendent of works for the new company, which will manufacture school and theater furniture, etc.

The Sudbury Construction & Machinery Company, Sudbury, Ont., will commence the erection of an addition to its plant to cost $6,000.

The Ontario Metal Products Company has taken over a building on Pearl Street, Toronto, and will enlarge it and install equipment for the manufacture of metal products.

The W. K. Kellogg Cereal Company, Ltd., Toronto, has taken over the Central Prison broom factory at Toronto and will make improvements and install $125,000 worth of machinery.

The Hall Motor Company has secured a building at Markham, Ont., and will install equipment for the manufacture of motor trucks, engines, etc. E. A. Hall is manager.

The Imperial Oil Company, Sarnia, Ont., will build an addition to its machine shop and construct ten more pressure stills.

The Imperial Oil Company, Sarnia, Ont., will purchase machinery, pumps, boilers, etc., for its refinery, to be erected at Regina, Sask.

J. A. Scythes & Co., 59 Paton Road, Toronto, manufacturer of cordage, etc., will build an addition to its plant, to cost $3,500.

The Martin Corrugated Paper Box Company will build a plant at 353 Pape Avenue, Toronto, to replace the one recently destroyed by fire. It will cost $16,000.

The Phoenix Iron Works, Vancouver, B. C., has been incorporated for $10,000 to operate a plant in Vancouver.

Fire did $100,000 damage to the plant of the Record Foundry & Machine Company, Foundry Street, Moncton, N. B. A quantity of machinery and patterns was destroyed.

Krug Brothers Company, Ltd., Chesley, Ont., is in the market for a 500-volt direct-current motor, from 5 to 10 hp.

Mr. Robert, P. O. box 762, Montreal, is in the market for a 50-hp. locomotive boiler, one air compressor, of 300 cu. ft. per min. capacity, etc.

The Chandler Machinery Company, Ltd., Chandler, Que., has been incorporated with a capital stock of $50,000 by A. Langlois, and others, to manufacture iron, steel, machinery, tools, implements, etc.

E. V. Buchanan, London, Ont., is working on plans for the installation of pumps at the waterworks plant.

Alexander Callender, Guelph, Ont., will commence construction work in the spring on a foundry which will cost $8,000.

The Louden Machine Company, Guelph, Ont., will build an addition to its plant to cost about $20,000.

The Emery Mfg. Company, Edmonton, Alberta, will rebuild its plant recently destroyed by fire with a loss of $100,000. A. E. Emery is president.

The City Council, Port Moody, B. C., is in communication with a large company which proposes to erect a shipbuilding plant there. P. D. Roe is chairman.

The Sheet Metal Products Company of Canada, Ltd., 199 River Street, Toronto, will commence the erection of an addition to its plant, to cost $20,000.

A large addition will be built to the McLagan Furniture Mfg. Company's plant a 93 Trinity Street, Stratford, Ont.

Bids are being received for the erection of the main buildings for the Vancouver Creosoting Company's plant, to be erected at North Vancouver, B. C., at a cost of $100,000. J. C. Storey is engineer.

The Canada Car & Foundry Company, 120 St. James Street, Montreal, will at once reconstruct its foundry and machine shop, which were recently destroyed by fire.

The Aeroplane Products, Ltd., Toronto, has been incorporated with a capital stock of $40,000 by Edwin G. Long, Bay and Melinda streets; John E. Belfry, 535 King Street West; Albert Mearns, and others, to manufacture aeroplanes, engines, etc.

The Fort William Docks, Ltd., Toronto, has been incorporated with a capital stock of $500,000 by James B. Taylor, Dominion Bank Building; William A. J. Case, 33 Brookmount Avenue; William J. Beattie, 421 Keele Street, and others, to build and operate docks, etc.

The Multisize Rotary Press Company, Ltd., Toronto, has been incorporated with a capital stock of $150,000 by George M. Willoughby, 25 Willcocks Street, Toronto; Joseph M. Bullen, 21 Grenadier Road, and others, to manufacture presses, machinery, etc.

R. R. Woods, Ltd., Toronto, has been incorporated with a capital stock of $40,000 by Malcolm Strachan, 225 Mavety Avenue; Charles D. Cutts, 24 Woodside Avenue; Robert R. Woods, and others, to manufacture hardware, builders' supplies, etc.

The Callander Foundry & Mfg. Company, Ltd., Guelph, Ont., has been incorporated with a capital stock of $40,000 by John M. Ferguson, 26 Adelaide Street West; Alexander C. Rutherford, 81½ Beech Avenue; John P. Walsh, and others, all of Toronto, to manufacture machinery, iron, etc.

Thomson-Gordon, Ltd., Hamilton, Ont., has been incorporated with a capital stock of $40,000 by George J. Thomson, Earl Gordon, Arthur B. Turner, and others, to manufacture machines, engine packings, mill supplies, etc.

The Smith Typewriter Company of Canada, Ltd. Montreal, has been incorporated with a capital stock of $50,000 by Francis H. Turner and William J. Jacot, Montreal; Edgar K. Stephenson, Syracuse, N. Y., and others, to manufacture typewriters, etc. Mr. Stephenson is manager.

The Metro Star Films, Ltd., Montreal, has been incorporated with a capital stock of $50,000 by Arthur Ecrement, Herbert Lubin, Montreal; Charles M. Cotton, Westmount, Que., and others, to manufacture motion picture machines, films, etc.

The Novelty Mfg. & Art Company, Ltd., Montreal, has been incorporated with a capital stock of $40,000 by Joseph Aron, Edward C. Baker, William N. Carin, and others, to manufacture jewelry, watches, electrical novelties, etc.

Government Purchases

WASHINGTON, D. C., Feb. 28, 1916.

Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, schedule 9333, for one foundry crane for Olongapo, P. I.; schedule 9334, for two cargo oil pumps for Mare Island; schedule 9335, for twelve blowers for Brooklyn; schedule 9338, for one steam hammer for Philadelphia; schedule 9339, for one wire-testing machine for Pensacola.

The purchasing officer of the Panama Canal, Washington, will soon call for bids for furnishing the following supplies:

One open-side planing shaper, capacity 15 in. wide by 60 in. long.
One turret lathe, for turning bar stock up to 2¼ in. in diameter, 24 in. long.
One wet tool grinding machine with heavy drop apron.
One plate planing machine, capacity 1¼ in. x 32 ft. plates.
One plate-bending roll, capable of bending plates up to 1 in. thick x 24 ft. in length or 2 in. in thickness x 6 ft. in length.
One pipe threading and cutting machine.
One 6-in. universal crank slotting machine.
One portable grinding attachment.
Two 25-hp. electric motors.
Two 5-hp. electric motors.

The depot quartermaster, United States Army, Washington, will receive sealed bids until 11 a. m. March 5 for furnishing f.o.b. cars Stofford Junction, Tex., for the quartermaster, Fort Clark, Tex., one 12-hp.. single-cylinder, four-cycle gasoline engine, direct connected through friction clutch to a triplex single-acting pump of 200-gal. per min. capacity.

The United States Reclamation Service, Interior Department, Washington, will receive sealed proposals until 2 p. m. March 8 for furnishing two pressure pumps of 30 gal. per min. capacity each.

Bids were received by the Bureau of Supplies and Accounts, Navy Department, Washington, Feb. 21, for supplies for the Navy Yard as follows:

Schedule 9262, Ordnance

Class 37, Washington—Two universal grinding machines—Bid 10, $867.50.

Schedule 9264, Construction and Repair

Class 42, Newport—One single-cylinder surface planing machine—Bid 11, $255; 43, $295, $275 and $200; 115, $320; 146, $348; 163, $238; 167, $700.

Class 43, Newport—One universal double-arbor saw bench—Bid 42, $371; 43, $384 and $435; 115, $350; 146, $227; 163, $234.83.

Schedule 9269, Construction and Repair

Class 62, Norfolk—One motor-driven core-wire straightener—Bid 9, $632, without spares.

Class 63, Norfolk—One disk grinder—Bid 43, $255.75; 50, no price; 115, $625; 153, $785.

The names of the bidders and the numbers under which they are designated in the above list are as follows:

Bid 9, Blake & Knowles Steam Pump Works; 10, Brown & Sharpe Mfg. Company; 11, Bentel & Margedant Company; 42, William H. Field Company; 43, J. A. Fay & Egan Company; 50, Gardner Machine Company; 115, Oliver Machinery Company; 146, H. B. Smith Machine Company; 153, Swind Machinery Company; 163, the Charles E. Wright Company; 167, the Woods Machine Company.

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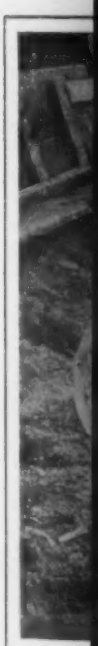

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